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THE VALUE OF COASTAL LAGOONS: CASE STUDY OF RECREATION AT RIA DE AVEIRO, PORTUGAL

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RESUMO

As lagoas costeiras são um dos ecossistemas mais produtivos, e ainda assim dos mais ameaçados, do mundo. Estas áreas naturais tem uma forte ligação com a sociedade dado que quase 40% da população humana habita nestas zonas. A degradação destes ecossistemas e dos seus bens e serviços é principalmente devido à sua conversão para uso agrícola, industrial ou residencial, sendo o resultado do aumento populacional e do desenvolvimento económico. Os serviços dos ecossistemas, definidos como os benefícios que as pessoas obtêm destas zonas húmidas, estão a tornar-se cada vez mais vulneráveis, uma vez que o seu valor para o Homem não tem sido corretamente considerado. Cerca de dois-terços dos serviços dos ecossistemas que compõem o capital natural do planeta são derivados do mar e dos biomas costeiros.

A preservação dos ecossistemas e dos seus serviços tem demonstrado uma influência positiva na subsistência e bem-estar das pessoas e, até mesmo, na redução da pobreza. Os recursos naturais são limitados, pelo que uma gestão eficiente dos recursos é crucial. O sucesso dos planos de conservação da natureza, segundo Mangel et al. (1996), envolve a incorporação de conhecimentos das áreas naturais e sociais, sendo que a abordagem dos serviços de ecossistemas é (amplamente) reconhecida como uma ferramenta útil para alcançar esta multidisciplinariedade. Esta perspetiva antropocêntrica aborda a utilidade dos ecossistemas através dos benefícios sociais que estes fornecem e tem tido uma relevância crescente na implementação de políticas de conservação da natureza.

A recreação e o turismo estão entre os serviços das zonas húmidas mais procurados pelas populações, com especial destaque junto às áreas mais urbanizadas. Estes contribuem para a melhoria do bem-estar humano a nível físico e psicológico. Estes serviços de ecossistemas culturais possuem valor de uso direto não-consumível, no entanto, a dificuldade na sua quantificação tem provocado a sua negligência na avaliação de *trade-offs* monetários entre diferentes opções de gestão. Contudo, os serviços recreativos e turísticos de um ecossistema possuem uma forte relação com a conservação dos recursos naturais do mesmo, tornando-se assim pertinente a sua integração na gestão das áreas naturais. A preservação da natureza permite a realização de atividades recreativas uma vez que providencia o ambiente onde estas atividades se desenvolvem, como é o exemplo da quantidade e qualidade de água necessária para a prática de desportos aquáticos na lagoa. O turismo de natureza, apesar de não tão evidente, pode também contribuir para a conservação do ecossistema. Existem áreas protegidas onde a receita obtida através do ecoturismo é investida em programas de conservação. No entanto existem outros benefícios da recreação e turismo tais como a disponibilização de informação e instalações que promovem a consciencialização e educação ambiental nos seus visitantes que, por sua vez, podem desenvolver atitudes e comportamentos pro-conservacionistas. A relação complexa entre a natureza e o Homem, característica deste tipo de serviços, apela à sinergia das ciências ecológicas e sociais. Assim sendo, os serviços de ecossistemas culturais representam uma importante ferramenta para uma gestão holística dos ecossistemas, através da integração da perspetiva sociológica do envolvimento público e da investigação económica para as avaliações monetárias. O objetivo deste estudo é então verificar a importância da avaliação de serviços de ecossistemas culturais, particularmente o uso recreativo, na gestão de uma lagoa costeira portuguesa, a Ria de Aveiro. Esta investigação multidisciplinar abrange uma abordagem nas áreas da economia, sociologia e ecologia do ecossistema.

Foram aplicados inquéritos em formato de papel diretamente aos utilizadores recreativos da Ria de Aveiro. O inquérito foi adaptado de um estudo australiano com foco idêntico e foi desenhado de

modo a permitir a recolha de informação para as análises sociológicas e económicas. A vantagem da utilização de um inquérito existente é estabelecer uma abordagem metodológica estandardizada passível de ser aplicada e comparada entre diferentes sítios do mundo. A informação recolhida durante dois meses (Agosto e Setembro de 2015) resultou num total de 386 inquéritos completos. Inclui assim uma abordagem sociológica do perfil dos utilizadores recreativos da Ria de Aveiro, através do *software* estatístico SPSS (23.0), e uma avaliação económica destes serviços de ecossistemas culturais estimando o valor monetário do uso recreativo (uso não-mercantil) com a aplicação de dois métodos de valoração económica: o método de custo de viagem (TCM, *travel cost method*) e o método de valoração contingente (CVM, *contingent valuation method*), através do *software* estatístico STATA (10.0). A área de estudo é a Ria de Aveiro, uma lagoa costeira na região centro de Portugal com uma elevada importância ecológica devido à sua diversidade de habitats e espécies, maioritariamente de aves. A região é considerada uma prioridade de conservação e possui áreas incorporadas na rede Natura 2000, Sítios Ramsar e uma reserva natural. As atividades recreativas e turísticas da zona são serviços de ecossistema bastante requisitados pelos seus visitantes.

As lagoas costeiras são importantes áreas recreativas encontradas por todo o mundo, no entanto raramente possuem informação sobre quem visita, de onde vem, as atividades realizadas, as motivações da visita e as preocupações dos seus visitantes. Deste modo, a abordagem sociológica deste estudo permitiu a recolha da, até então inexistente, informação das características sociodemográficas dos visitantes da Ria de Aveiro, bem como as atividades que praticam, as razões da visita e ainda algumas opiniões pessoais. O perfil sociodemográfico dos visitantes contribui para perceber alguns dos seus comportamentos relativos às atividades e motivos da visita, permitindo refletir sobre a procura e as necessidades das pessoas aquando da visita recreativa. As principais atividades praticadas e razões da visita desta lagoa costeira dependem das características demográficas dos visitantes (tais como idade, sexo, nacionalidade e rendimento), ou seja, diferentes tipos de pessoas têm preferências recreativas diferentes. Os vários municípios envolventes da Ria de Aveiro demonstraram influenciar o tipo de visitante bem como as atividades realizadas, o que indica ser relevante a aplicação de políticas de gestão distintas. De acordo com os inquiridos, a experiência recreativa geral desta área costeira permite principalmente relaxar, entrar em contato com a natureza, socializar, e fazer atividades ao ar livre, turismo urbano e pesca. A elevada preferência de atividades de turismo de natureza, ditas apreciativas, é indicativa de atitudes e comportamentos pró-conservacionistas. Assim, a análise desta informação torna-se bastante útil para o desenvolvimento de estratégias de planeamento e gestão destas áreas de uma forma mais eficiente tendo em conta os seus visitantes. A gestão da área poderá atingir objetivos de conservação através do incentivo da prática destas atividades em detrimento de outras com impactos negativos no ecossistema e através do investimento da consciencialização e educação ambiental.

De modo a evitar a perda e degradação dos ecossistemas, a identificação e a quantificação dos seus serviços tem sido bastante requisitada. Assim, diferentes métodos de atribuição de um valor monetário aos benefícios sociais dos ecossistemas têm ganho recentemente popularidade e aceitação entre os responsáveis por tomadas de decisão. Embora alguns serviços dos ecossistemas, principalmente os de produção, possam ser trocados no mercado por um determinado preço, a maioria dos serviços, incluindo os culturais e de regulação, não são negociados diretamente por um valor monetário. Os serviços de ecossistemas culturais, como é o caso da recreação, necessita de técnicas específicas de valoração para estimar o seu valor "não-mercantil", permitindo assim traduzir economicamente a sua importância ecológica. Os valores estimados de excedente de consumo obtidos com o método TCM foram cerca de 100 € e 105 € (por adulto e por dia), para a variável de custo de viagem relatada e estimada, respetivamente, e com o método CVM de 53 €, para o valor calculado através da variável de custo de viagem estimada. Estas estimativas fornecem uma contribuição valiosa, garantindo assim que os

serviços culturais de um ecossistema não são negligenciados e que o seu valor possa ser incluído em análises de custo-benefício das decisões de gestão. Os ecossistemas sob políticas de conservação geralmente fornecem vantagens económicas que, na maioria dos casos, são iguais ou maiores do que o custo da conservação.

A proteção da natureza apenas por si só, pelo seu valor intrínseco, não tem sido um argumento de conservação bem-sucedido. A conservação destas áreas costeiras de importância ecológica e recreativa requer estratégias de gestão bem fundamentadas e completas, através de conhecimentos nas áreas biológicas e sociais, devido à forte relação entre a natureza e do Homem. Uma abordagem integrada com participação pública e com a avaliação monetária dos benefícios sociais relacionados com os serviços de ecossistema aumenta a aceitação social das políticas de gestão e, desse modo, tem maior probabilidade de sucesso. Iniciativas políticas para a conservação dos ecossistemas marinhos e costeiros têm vindo a expandir-se a nível internacional, europeu e nacional. Estas têm como objetivo avaliar as condições e tendências dos ecossistemas mundiais e os serviços que prestam, bem como melhorar a base científica para usá-los de forma sustentável através de tomadas de decisão. O presente estudo revela evidências empíricas do serviço recreativo desta lagoa costeira, através do perfil dos visitantes e da avaliação do seu valor económico, que pode ser amplamente utilizado pelos gestores nos processos de tomada de decisão. Assim, fornece uma justificação sociológica e económica da alocação de recursos financeiros para a conservação da natureza.

Palavras-chave: lagoas costeiras, serviços de ecossistemas culturais, perfil de visitante, valoração económica, gestão ambiental

ABSTRACT

Coastal ecosystems are some of the most productive and yet threatened in the world. A key feature for successful conservation plans includes the integration of natural and social domains of science to improve environmental management strategies. The Ecosystem Services (ES) approach is widely recognized as a useful tool to integrate sociological and economic knowledge in environmental issues. Recreation and tourism are among the most demanded services of coastal lagoons, mostly in more urbanized areas, and have great benefits to physical and psychological human wellbeing. The aim of this study is to combine sociological perspective of public involvement and assess the economic value of this service to evaluate the importance of cultural ecosystem services so as to assist in the management strategies of a Portuguese coastal lagoon, Ria de Aveiro.

The first part of this study was focused on the sociological aspects of recreational services of Ria de Aveiro lagoon and included the assessment of visitor's sociodemographic characteristics and behaviors, along with their personal interest and opinions. The information gathered here enables the perception of their needs and demands for a recreational site, providing useful information for managers and decision-makers. The main activities undertaken and the reasons for visiting this coastal lagoon are dependent on visitor's demographics (such as age, gender, nationality and income), i.e. different people have different recreational preferences. The municipalities within Aveiro region were also found to influence the activities and reasons that people chose, meaning that it may require different management strategies. According to respondents, the overall recreational experience of this wetland allows mainly relaxation, contact with nature, outdoor activities, social gathering, urban tourism and fishing. Most activities visitors undertook at this site are appreciative recreation activities (related with nature-tourism) that are considered to have an influence on adopting pro-environmental attitudes and behaviors. Therefore, this information input contributes to a better acknowledge of recreational visitors. Thus, it can enhance management decisions concerning conservation goals by promoting these type of appreciative activities, over others with a negative impact on the ecosystem, and by investing in environmental awareness and education.

The economic valuation of these non-market cultural services enables the translation of their ecological importance into monetary terms. For the appraisal of non-market values, such as the case of recreational use, standard economic valuation techniques, such as travel cost (TCM) and contingent valuation (CVM) methods, have been applied. Estimated values of consumer surplus obtained with the TCM method were between 100€ and 105€ (per adult and per day), and 53€ with the CVM method. This monetary value obtained can be better perceived by scientists, managers, policy makers and all stakeholders, and it can be included in cost-benefit analyses of alternative management options of coastal lagoon (including conservation plans). These estimates provide an important input ensuring that cultural ecosystem services are not disregarded and that their value can be included in management decisions. Ecosystems under conservation policies generally provide economic advantages that, in most cases, are equal to or even greater than the cost of conservation.

The argument for protecting nature because of its intrinsic value hasn't been successful in achieving conservation goals. Proper management of the ecosystem and its services has an increased social acceptance and thus is more likely to succeed if it is applied using integrated approaches with public involvement and with monetary assessment of social benefits related to the ecosystem services. The current study reveals empirical evidence of the recreational service of this coastal lagoon, by

profiling visitors and assessing its economic value, which can be widely used by managers in decision-making processes. Therefore, it provides a sociological and economic justification of the allocation of financial resources towards nature conservation.

Keywords: coastal lagoons, cultural ecosystem services, visitor profile, economic valuation, environmental management

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ABBREVIATIONS

AIC	Akaike Information Criteria
AUD	Australian Dollars
BIC	Bayesian Information Criteria
CBA	Cost-Benefit Analysis
CI	Confidence Intervals
CIA	Environmental Interpretation Center
CICES	Common International Classification of Ecosystem Services
CPI	Consumer Price Index
CS	Consumer Surplus
CVM	Contingent Valuation Method
DUV	Direct Use Value
EEA	European Environment Agency
ES	Ecosystem Services
ESV	Ecosystem Services Valuation
EU	European Union
ITCM	Individual Travel Cost Method
IUV	Indirect Use Value
MA	Millennium Ecosystem Assessment
NGOs	Non-Governmental Organizations
NUV	Non-use Values
OUV	Option Use Value
SCI	Site of Community Importance
SPA	Special Protection Area
TC	Travel Cost
TCM	Travel Cost Method
TEEB	The Economics of Ecosystems and Biodiversity
TEV	Total Economic Value
UV	Use Values
WTA	Willingness to Accept
WTP	Willingness to Pay
ZTCM	Zonal Travel Cost Method

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I - INTRODUCTION

I.1 THEORETICAL FRAMEWORK

I.1.1 Coastal Lagoons

Coastal lagoons and their wetlands represent one of the Earth's most productive ecosystems, providing a wide range of ecosystem goods and services essential to life on the planet (Camacho-Valdez et al., 2013; IUCN, 2007; Nunes & Gowdy, 2015). Coastal lagoons are considered ecosystems of key importance to the biosphere given that they are responsible for almost all biogeochemical processes (Sousa et al., 2013), allowing support to a large biological diversity. Nearly 40% of the human population live within 100 kilometers of the coast and these areas are still experiencing growing populations along with exploitation pressures (Willaert, 2014). Despite their proven importance, these coastal systems are some of the most threatened in the world (MA, 2005) and the goods and services they provide are becoming increasingly vulnerable (Agardy, 2010). This is the result of the attempt to respond to growing human needs and economic development (MA, 2005).

Wetlands, including those that are part of coastal lagoons, may be destroyed by pollution, water withdrawal, overharvesting and overexploitation, introduction of invasive alien species and other influences (MA, 2005). However, the main cause of degradation of these ecosystems is their conversion to agricultural, industrial or residential use (Barbier et al., 1997), with half of the world's wetlands being lost over the past century to physical alterations (UNEP, 2002). One of the main reasons is that wetlands are still treated as though they have little or no value to humans (Sousa et al., 2013), although an estimated two-thirds of the ecosystem services that make up the planet's natural capital are derived from ocean and coastal biomes (TEEB, 2012).

I.1.2 Conservation Principles

Uncontained human growth and the intensification of resource use are unsustainable because they are inconsistent with a finite system (MA, 2005; TEEB, 2010). However, conservation of all resources and all ecosystems is an unrealistic goal that emphasizes the importance of effective management of the limited natural assets. Furthermore, limited financial capital budgets make it essential to develop an adequate way of prioritizing, or 'ranking', options for how best to preserve the environmental resources at regional, national and international levels (Barbier et al., 1997).

Mangel et al. (1996), in a remarkable paper, brought together several "Principles for the Conservation of Wild Living Resources". They highlight the need to integrate the knowledge and skills from the natural and social sciences into conservation problems. Conservation policies have been failing to include interdisciplinarity in societies where natural ecosystems are highly connected with human populations (Knight et al., 2006). Conservation's principles also include the importance of "understanding and taking account of the motives, interests, and values of all users and stakeholders". Therefore, all the relevant disciplines, including biological, economic and social disciplines, must be involved in the appraisal of ecosystem management policy at all stages, from the assessment of the issues, passing the policy implementation, up to the monitoring and evaluation of the policy (Robinson, 2006).

I.1.3 Ecosystem Services Framework

The need for a transdisciplinary research to achieve conservation and sustainability goals has launched the so-called "ecosystem services framework" into environmental management and decision-making processes (Lele et al., 2013; Turner et al., 2008). The Millennium Ecosystem Assessment (MA, 2005) was responsible for the popularization of the concept. It defines Ecosystem Services (ES) as "the functions and products of ecosystems that benefit humans, or yield welfare to society" (see Figure 1). According to the MA (2005), 60% of all ES evaluated are being degraded or used unsustainably.

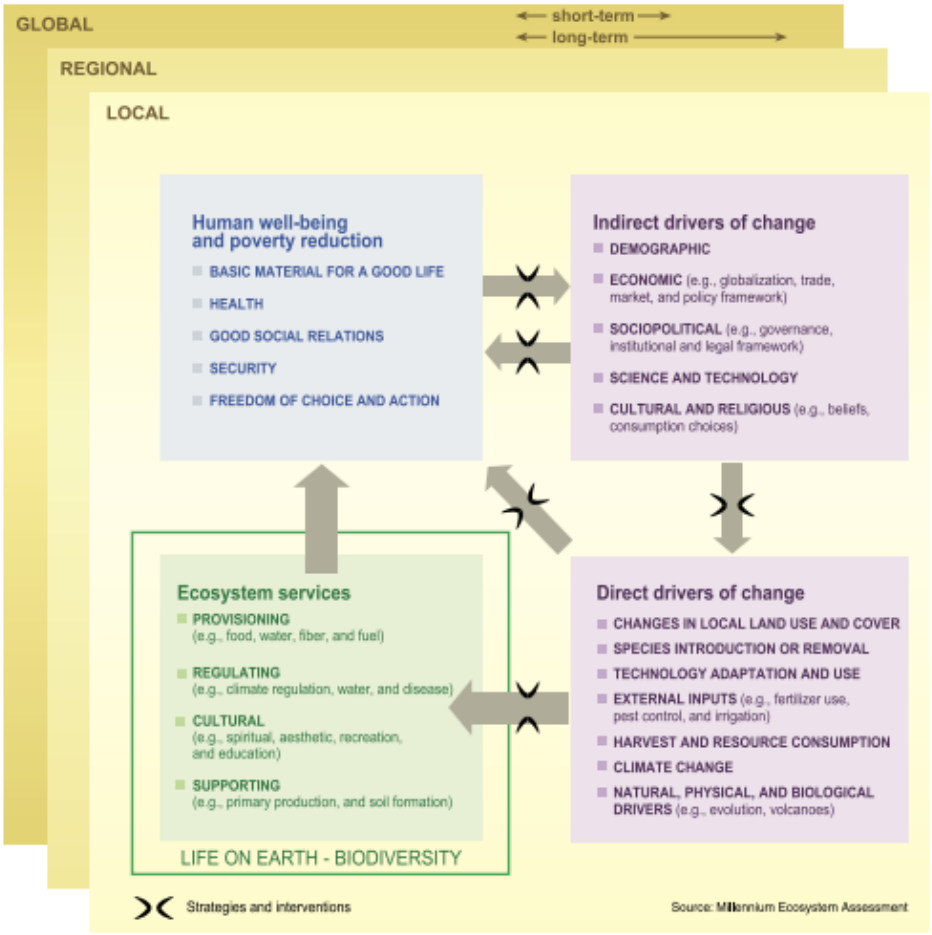

Figure 1: The conceptual framework of the Millennium Ecosystem Assessment (MA, 2005).

This utilitarian and anthropocentric approach has become widely accepted among government institutions, non-governmental organizations (NGOs), the academic community and the private sector, although it has been a subject of debate among conservation scientists (Ingram et al., 2012). Even if the ultimate objective of the ES approach may not always be biodiversity conservation, it has a major impact as an intermediate tool for that purpose. According to Ingram et al. (2012), there are three main benefits of ecosystem services approaches for biodiversity conservation: the ES approach has the potentiality of informing decision-making and engaging stakeholders who apparently hadn't conservation interests but, with services in mind, they invest in policies that contribute to ecosystem conservation; the numerous services generated in protected areas (e.g. regulating services) may act as an argument for funding programs and managing these areas specially designed for conservation purposes; lastly, for non-

protected areas that are as important for conservation as the protected ones, the wider-accepted importance of ecosystem services may lead to a sustainable management of land and water areas resulting in positive consequences for conservation.

MA (2005) provided a classification for ecosystem services that is globally recognized however, it has some fragilities related to its simplicity. This classification can lead to confusion and different interpretations. The Economics of Ecosystems and Biodiversity project (TEEB, 2010) followed the MA and provided an updated classification, also grouping ecosystem services into four broad categories, though it replaced 'supporting services' with 'habitat or supporting services', which comprise 'habitats for species' and 'maintenance of genetic diversity'. It proposed a new definition of ecosystem services that consists in "the direct and indirect contributions of ecosystems to human well-being". TEEB project clarifies a finer distinction between services and benefits and explicitly recognizes that services can benefit people in multiple and indirect ways (TEEB, 2010). More recently, there has been a proposal for a Common International Classification of Ecosystem Services (CICES), developed to support the work of the European Environment Agency (EEA) on Integrated Environmental and Economic Accounting, in which "ecosystems services are defined here as the contributions that ecosystems make to human well-being, and arise from the interaction of biotic and abiotic processes" (Haines-Young & Potschin, 2013). Therefore, it focuses on final services, which are the 'final' outputs or products from ecological systems, that is, the things directly consumed or used by people. CICES presents clear distinction between ecological phenomena (functions, processes and structures), their direct and indirect contribution to human welfare (final ecosystem services), and the welfare gains they generate (benefits). Thus, services have social as well as economic value (Figure 2). A standardization in the definition of ecosystem services enables them to be described and measured, and therefore they can be valued, mapped and included in environmental accounting (Haines-Young & Potschin, 2013).

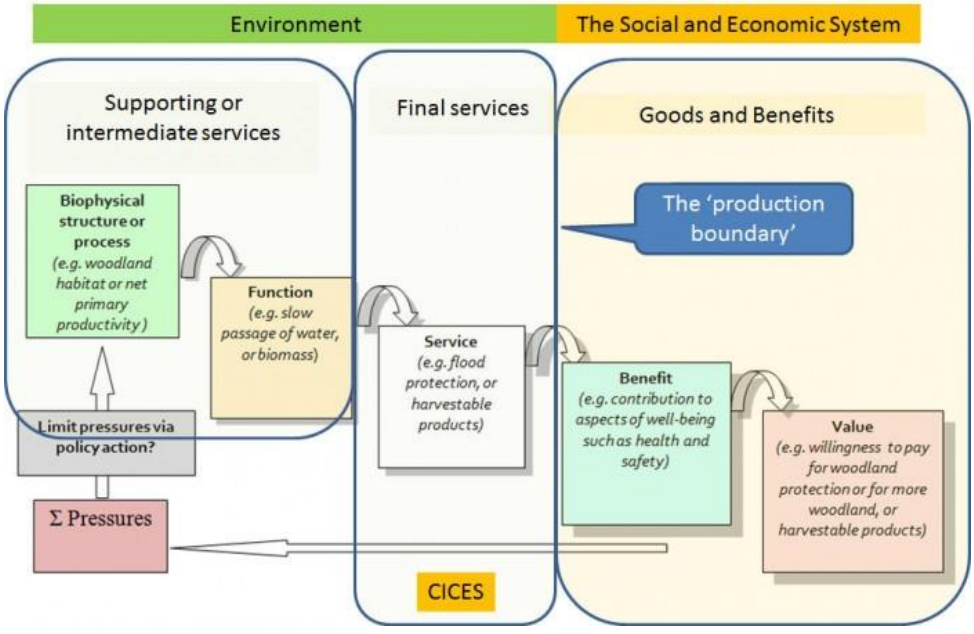

Figure 2: The Ecosystem Service Cascade. Source: Haines-Young & Potschin (2013)

Recently, literature has been widely covering this approach, being increasingly applied in natural resource management and conservation studies (Daily et al., 2009; Goldman et al., 2008; Tallis & Polasky, 2008; Turner & Daily, 2008). Although the approach is grounded on natural sciences, it relies on social appraisal and economic analysis to assess the values attached to the diverse ecosystem services (Atkinson et al., 2012; Fisher et al., 2009). The services' values generated will then serve as input for the decision-making process and management of areas with conservation concerns (Carpenter et al., 2009; Chan et al., 2006; Daily, 2000; De Groot et al., 2010; Egoh et al., 2007; Goldman et al., 2008).

I.1.4 Coastal Ecosystem Services

The main services provided by marine and coastal ecosystem, following by the MA classification (MA, 2005), are (1) provisioning ES: food (mainly fish and shellfish), fiber, timber, fuel, medicines and other resources; (2) regulating ES: freshwater storage, hydrological balance, climate regulation, erosion control, flood protection, water purification; (3) supporting ES: oxygen production, nutrient cycling and fertility; and (4) cultural ES: recreation, ecotourism, cultural and amenity, aesthetics, education and research (Barbier, 2012; Lopes & Videira, 2013). These ecosystems also have a major role in regulating the fluxes of water, nutrients and organisms between land, rivers and the ocean (Newton et al., 2013). Two of the most important wetland ecosystem services affecting human populations involve fish supply and water availability, being of particular importance in developing countries (Haines-Young & Potschin, 2013). For some rural communities living near wetlands, inland fisheries are the main, and sometimes only, primary source of animal protein to which they have access, contributing to human well-being and poverty alleviation as well (MA, 2005). Many economic activities take place in these coastal ecosystems, of which the major ones include agriculture, aquaculture, fishing, tourism, water sports, shipping, dredging, salt extraction and industrial development (Newton et al., 2013).

The ability of ecosystems to provide sufficient ecosystem services to people not only supports basic human needs, but has also been proved to be beneficial in various aspects of human health and the general feeling of well-being (Fisher et al., 2009). Several studies have reported benefits from physiological to mental and psychological health improvements (see details in Sandifer et al., 2015). These areas are ecologically and economically valuable due to the range of goods and services they provide, but highly vulnerable as well. Therefore, these socio-ecological systems have an important value making it crucial for the conservation of ecosystems and their services (Barbier et al., 2011).

I.1.5 Recreation and Conservation

Recreation and tourism can be considered, instead of cultural ES as proposed by the MA (2005), benefits that derive from cultural ecosystem services (Boyd & Banzhaf, 2007). Recreation and tourism are human activities in which its experience provides nonmaterial benefits to people and they are included in the non-consumptive direct use values of an ecosystem (see details in Figure 33). It is widely accepted that a coastal lagoon has plenty of consumptive uses to offer to human populations, such as fish, shellfish, timber, and so on, however it is the non-consumptive uses that generate most of the social benefits (Costanza et al., 1997). Non-consumptive uses of a wetland involve contact between people and the habitat, and depend on the physical, biological, and geological characteristics of the wetland. Recreation and tourism are a very important component of coastal lagoons' ecosystems, meaning that people choose to spend their leisure time in these natural areas (Lankia et al., 2015). Outdoor recreation consists in the "experiences that derive from recreation activities in and depending on the natural environment" (Moore & Driver, 2005). When performed away from the home area outdoor recreation is also considered tourism, and more specifically nature-based tourism, or nature tourism. This is in line with the definition of nature-based tourism that includes "the activities of people residing in natural

areas outside their usual environment" (Wolf-Watz et al., 2011). In this matter, there is such a slight distinction between outdoor recreation and nature-based tourism so that it can be disregarded.

In a highly urbanized society as today's, the urgent demand for natural environments for touristic and recreation activities has been boosting this new industry in many ecosystems (Chiesura, 2004). This new type of nature tourism, emerged in the 70s, in response to the growing need to escape from a hectic lifestyle and to get in contact with nature and local cultures. The demand for this type of service is greater in more urbanized societies where the city life is more stressful and green spaces are scarcer (Chiesura, 2004; Matsuoka & Kaplan, 2008; Yilmaz, et al., 2007).

Tourism has a strong relationship with conservation of the natural assets of an ecosystem and in fact, according to Eagles et al. (2002) 'protected areas need tourism, and tourism needs protected areas; tourism is always a critical component to consider in the establishment and management of protected areas'. Nonetheless, conservation supports tourism more often than tourism supports conservation (Buckley, 2013). In the case of coastal lagoons, conservation and management of natural resources, such as its flora, fauna and geology, not only improves the physical attractiveness of the environment but it also allows visitors to pursue their recreational activities. Thus recreation is intrinsically dependent on ecological conditions which are themselves the ecosystem services, so that the maintenance of species and habitats diversity becomes highly relevant (Fuller et al., 2007; Naidoo & Adamowicz, 2005; Nyaupande & Poudel, 2011). For example, water sports require certain properties and good quality of the water body (water depth and width, water speed, wind protection, etc.), camping and bushwalking need an adjacent naturalistic land, birdwatching is dependent on a high amount of bird species, fisheries require a high abundance and diversity of fish species (Dyack et al., 2007). Almost all the nature-related activities are dependent on the preservation of the ecosystem and are enhanced by the provision of facilities that provide good quality access, such as trails, paths and information boards. Recreationists, therefore, would be expected to directly benefit from wetlands protection programs.

Nature tourism, although not so evident, may function as a contribution to ecosystem preservation as well. Recreational and tourism opportunities are also co-benefits of nature conservation (Schägner et al., 2016). Sustainable tourism goals intend that some of the profits generated are allocated to the management and protection of habitats and biodiversity. There are some protected areas where tourism revenue raised from entrance and activity charges is invested in the conservation of threatened species, through habitat restoration, anti-poaching efforts and control of invasive species (Buckley et al., 2012; Morrison et al., 2012; Naidoo & Adamowicz, 2005; Steven et al., 2013). Important benefits from recreation and tourism include as well providing access to information and amenities that promote environmental awareness and education in visitors that may develop attitudes towards nature conservation (Nyaupane & Poudel, 2011; Stem et al., 2003).

Recreation and tourism yield numerous relevant benefits to people such as physical exercise, aesthetic experiences, intellectual stimulation, inspiration, reducing stress and depression, improving social relationships, and others also related to physical and psychological well-being (Daniel et al., 2012; Milcu et al., 2013). Health benefits derived from outdoor recreation areas are widely reported (Godbey, 2009). Tourism activities also present a non-trivial economic value to local development by generating employment and marketing for local goods and services (Nyaupane & Poudel, 2011). However, the idea that they are intangible and difficult to quantify has led to a poor characterization and valuation of these benefits (De Groot, 2006; Fletcher et al., 2014; Milcu et al. 2013). The recognition of the importance of these benefits is critical for understanding the link between environment and culture and to assess trade-offs between different management options (Chan et al., 2012; Satz et al., 2013; Schipperijn et al., 2010). Otherwise, the exclusion of cultural values from ecosystems assessments would lead to an underestimation of values for the ecosystem in question and could lead to potential undetermined losses

(Milcu et al., 2013). Thus, having better information about recreational benefits provides input to better land-use planning and presents a strong argument in favor of allocating financial resources towards nature conservation (Balmford et al., 2015; Milcu et al., 2013).

I.1.6 Importance of an Integrated Approach

The complex relationship between nature and people, which is a distinction of recreational benefits, calls for the integration of ecological and social sciences in order to achieve nature conservation goals (Daniel et al., 2012; Endter-Wada et al., 1998; Knight et al., 2006; Pohl, 2005; Pregernig, 2006; Turner et al., 1996). These benefits are an important tool for a holistic management of ecosystems through the synergy of the economic research for economic assessments and the socio-psychological perspective with public involvement (Milcu et al., 2013). By means of engaging people and accounting for social values, recreational benefits have the ability to raise the ES approach to a higher level (Kumar & Kumar, 2008). Therefore, to better appraise recreation and tourism in an ES framework, it is crucial to gather qualitative and quantitative information from social science domains based on an improved cooperation between scientists, policy makers and stakeholders (Daniel et al., 2012).

Sociological information regarding recreational visitors' characteristics and behaviors provides relevant knowledge of people's needs and demands (Chiesura, 2004; Schmitz et al., 2007). Policies and management planning that account for public involvement in decision-making processes improves local knowledge and social acceptance, therefore they are more likely to be successful (Endter-Wada et al., 1998; Matsuoka & Kaplan, 2008). The identification and quantification of cultural services in monetary terms is also crucial for the translation of their ecological importance into a common economic currency. This market value allows the assessment of monetary trade-offs between alternative management options in a situation where financial resources are limited. All this information is valuable for management decisions and may contribute to a social and economic justification for the allocation of financial capital to nature conservation.

Detailed explanations of the sociological and economic approaches mentioned above will be further presented in the introductory section of each chapter of this thesis.

I.2 AIMS AND OBJECTIVES

The aim of this study is to combine sociological and economic perspectives to assess the importance of recreational experience, a benefit provided by cultural ecosystem services, so as to assist in the management strategies of a Portuguese coastal lagoon, Ria de Aveiro. This will be achieved by providing evidence of the value of the cultural ecosystem service in Ria de Aveiro lagoon demonstrating the need for conservation of this service and the whole ecosystem. This study will also fill the knowledge gap concerning relevant information about Ria de Aveiro's visitors profile and the value they assign for the benefits they receive from the recreational experience. This multidisciplinary research encompasses economics, sociology and ecology of the ecosystem.

There are three main questions that drive this research and that are of regional and global interest:

1. How can visitor profiles influence recreational behavior in coastal lagoons?
2. Can non-market value estimates in monetary terms account for cultural ecosystem services and increase our understanding of people's preferences about values of coastal lagoons?
3. How can such values and findings be used in planning and other management decisions on a local level and for global decisions as well?

I.3 THESIS OUTLINE

This thesis is organized in three main sections. The first introductory part (I) includes a Theoretical Framework (I.1) approaching some review of the literature relevant for this study, the clarification of the Aims and Objectives (I.2), this Outline (I.3), a characterization of the Study Area (I.4) and a description of the Implementation of the Survey (I.5), since the sampling methodology used is common to the following sections.

The second part, Sociological and Economic Approach (II), is divided in two main sections: Visitor Profile (II.1) and Economic Valuation (II.2). Visitor Profile section provides a sociological approach of the recreational users of Ria de Aveiro and has the classic structure with an introduction (II.1.1), methods (II.1.2), results (II.1.3), discussion (II.1.4) and conclusion (II.1.5). Economic Valuation (II.2) provides an economic assessment of cultural ecosystem services by providing a monetary estimate of the value of recreation (non-market value). This section begins with an introduction (II.2.1) to the economic concepts that form the basis for the valuation methods and, because two techniques were applied, it is divided in: II.2.2 - Travel Cost Method (TCM) and II.2.3 - Contingent Valuation Method (CVM). Each section of the valuation techniques provides an introductory Statistical Framework (II.2.2.1 and II.2.3.1), definition of the Data and Methods (II.2.2.2 and II.2.3.2) and the Results and Discussion of the econometric models obtained (II.2.2.3 and II.2.3.3). After this, a Discussion (II.2.4) about both techniques and economic valuation itself is presented. At the end of this part, a Conclusion (II.2.5) is provided.

A third section (III) provides a general discussion of the whole thesis, starting with some general considerations (III.1), followed by the implications of the results for conservation and management (III.2) and at last, some final remarks (III.3).

I.4 STUDY AREA

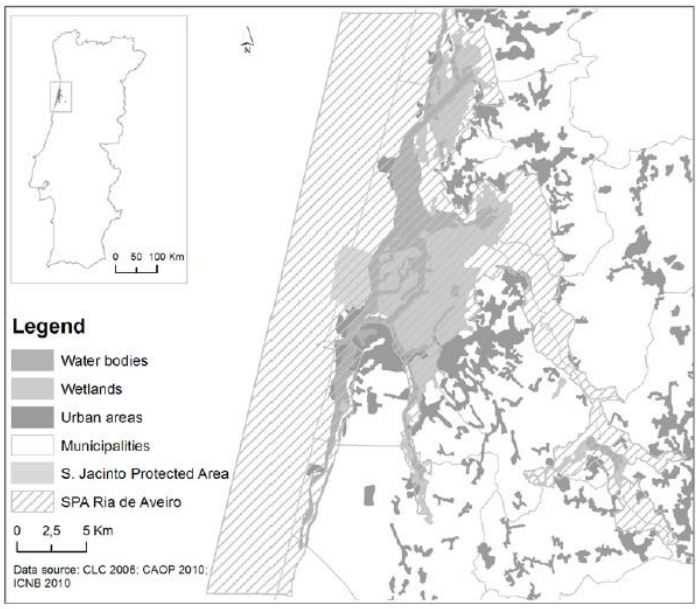

Figure 3: Ria de Aveiro map with land use and protected areas. Source: Sousa et al. (2011).

The Ria de Aveiro (Figure 3) is a shallow coastal lagoon located on the Northwest Atlantic coast of Portugal (40°38′N, 8°45′W), with an average depth of 1m (Dias et al., 2000). It is a bar-built estuary, protected from the ocean by a barrier island (Dias & Lopes, 2006) and has an irregular geometry, characterized by some elongated and branched channels (as an arborescent network system; Martins et al., 2011). This lagoon is 45 km long and 10 km wide and covers an area from 64.9 km^2 to 89.2 km^2 at neap and spring tides, respectively (Lopes et al., 2015), having only one connection with the Atlantic Ocean through an artificially opened channel (Dias et al., 2000).

The coastal lagoon of Ria de Aveiro is a transition area between aquatic and terrestrial systems as well as freshwater and marine systems, integrating urban, natural and semi-natural areas (Figure 4; Sousa et al., 2016). The great diversity in habitats, including seagrasses beds, salt marshes, intertidal mudflats, salt pans, rice fields, coastal dunes, agro-ecosystems, woodlands and freshwater rivers and lakes (Lillebø et al., 2015), are used as nursery areas for many biological groups that include bivalves, crustaceans, fish and birds (Sousa et al., 2013). The Ria de Aveiro is one of the main and biologically more productive wetland area of Portugal (Albuquerque et al., 2009). Due to the vast range of critically relevant habitats and the crucial importance for migratory, rare or vulnerable bird species, Ria de Aveiro site has been considered a priority for conservation in a European context, being incorporated in the Nature 2000 network as a Special Protection Area[1] (SPA) and a Site of Community Importance (SCI; Sousa et al., 2016). This region has also a natural reserve (São Jacinto Dunes Nature Reserve), classified by the Portuguese Institute for Nature Conservation and Forests (ICNF), and areas included in Ramsar Sites (Pateira de Fermentelos Lake and Águeda and Cértima Valleys[2]), in recognition of the international wetland importance under the Ramsar Convention.

[1] Code: PTZPE004
[2] ID: 2089

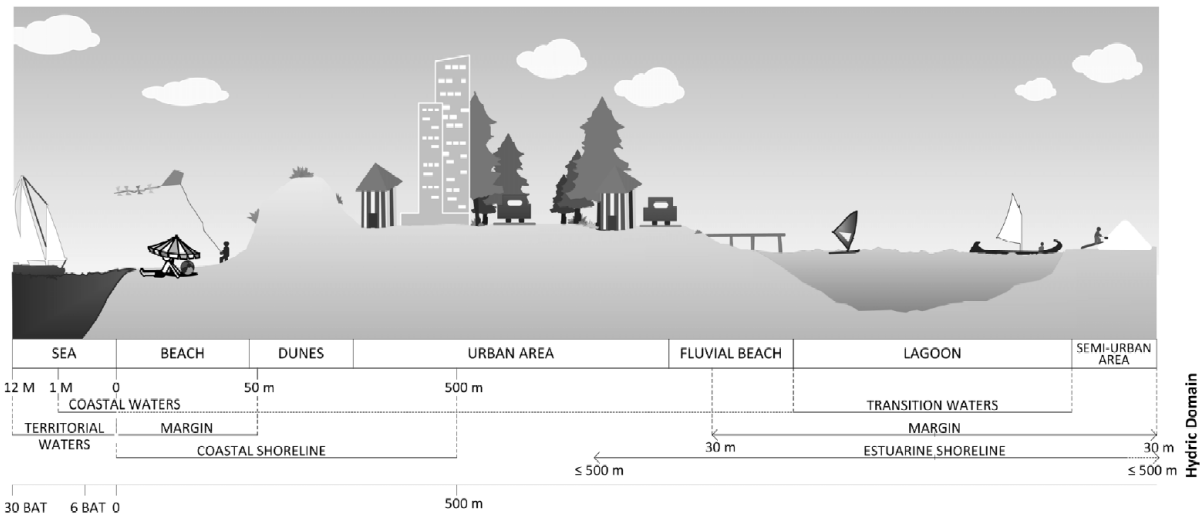

Figure 4: Main landscape use of both terrestrial and marine space of study area. Source: Sousa et al. (2011).

This ecosystem provides a wide range of goods and services. The main services include provisioning services (nutrition; materials; and energy), regulation and maintenance services (e.g. mediation of waste, toxics and other nuisances; mediation of flows) and cultural services (physical and intellectual interactions with biota, ecosystems, and land- /seascapes environmental settings; Sousa et al., 2016). The economic benefits identified in this region are essentially from maritime port activity and fishing, activities such as agriculture and livestock, industry; tourism and recreation are of major importance as well (Lillebø et al., 2011).

I.5 SURVEY IMPLEMENTATION

The questionnaire used in Ria de Aveiro (Appendix 1) was adapted from an Australian one with identical study focus, already put in practice and reported in Rolfe & Dyack (2010). The questionnaire design enabled gathering of information for the sociological and economic analysis approaches applied here to the recreational use of study site. The range of information collected about sociodemographic characteristics of visitors to information about recreational trips and behaviors allowed the characterization of the visitor profile and estimation of the economic value of cultural ecosystem services. The use of an existing survey, but adapted to this site, is important as a way of establishing a standardized survey approach to apply in different sites so as to make them comparable worldwide. Comparability is a major issue in achieving global relevance.

The Australian survey was developed in 2005 using standard techniques designed to determine attributes of the visitors, identify the values of non-market use of current recreational activities and identify the potential changes in non-market use values that might be associated with changes in the level of access to recreation areas, along with the collaboration of various scientists from ecological, social and economic disciplines and local site managers. The original questionnaire was adjusted to suit the Portuguese reality in terms of the questions concerning the geographic localization of the study area and the current ecological situation of Ria de Aveiro. There was a Portuguese, an English and a Spanish version of the questionnaire, which was thought to be the languages most spoken and universal of the site. Copies of the surveys used are provided in Appendix 1.

The survey instrument used to collect information from recreational users was a direct contact, paper-based questionnaire, which was completed by the visitor on his or her own (in groups, one person completed the questionnaire) with pickup shortly after. The bulk of the questions was closed, just

requiring a number, ticking-off a series of options, or a response to an attitudinal scale. The survey approach was to intercept as many visitors as possible at random in different parts of the lagoon and ask them to answer the questionnaire (the sites are illustrated in the first page of the questionnaire). The questionnaire (Appendix 1) was as simple and short as possible given that a range of information was required in order to provide information about:

- sociodemographic characteristics of visitors;
- current visitation rates and patterns;
- preferences and attitudes to recreation;
- values of current recreational activities (relevant input to be assessed with economic valuation methods);
- potential impact of changes in access to recreation areas in the visitation rates.

The survey collection phase had the duration of two summer months: August and September of 2015. In order to have a representative sample of the variety of recreational users, numerous sites and time periods were included in the sampling so that small 'clusters' of respondents were targeted. For the purpose of getting robust statistical analysis, a large number of responses was collected. The survey was generally well received by the visitors with approximately 25% of refusal rate, mainly due to its length. In total, 386 completed and usable questionnaires were collected. Answers were at first codified and inserted into a database and then analyzed according to the focus.

II – SOCIOLOGICAL AND ECONOMIC APPROACH

II.1 – VISITOR PROFILE

II.1.1 INTRODUCTION

A prevalent quest of nature conservation is to find a strategy to integrate the increasing demand and pressure for recreation and tourism in natural areas without compromising the ecological integrity of the ecosystem (Gössling, 2002). Many of the sites that engage people for recreation are also characterized for nature conservation interest (Bathe, 2007). This topic has a particular emphasis in coastal areas since coastal ecosystems are often very attractive to visitors and the contact between people and wildlife is frequent (Fearnley et al., 2012). Recreational use and nature conservation have been typically seen as opposing goals, however it is now becoming recognized that there is a utility to visitation of some important ecosystems in achieving conservation goals (Bathe, 2007). Participation in outdoor recreation, especially some ecotourism activities, is assumed to promote environmental awareness leading to pro-conservation attitudes that are thought to predispose people to environmentally responsible behaviors (Eagles, 2002; Lee & Moscardo, 2005; Tarrant & Green, 1999).

In order to use tourism as a tool for conservation purposes, Buckley (2013) acknowledged that a study should be done into the behavior and psychology of tourism visitors of each site. A correct perception of the users of a recreational site is essential not only for the conservation of nature but it is also important for the management of the area. The management of recreational ecosystem services is dependent on how they are perceived by people, so there is a need to take that into consideration for an improved management process (Daily, 2000; Sayan & Karaguzel, 2010). The information collected from visitors is then crucial for improving policies, planning, reporting, researching and real life comparisons, achieving relevance at regional, national and even international levels (Drábková, 2012; Sayan & Karagüzel, 2010; Schmitz et al., 2007). It is then essential to define a standardized manner of collecting data in order to produce information that can be comparable and usable in different areas and over time, and that can and should be available to visitors themselves as well as to the general public.

Understanding visitor characteristics is a main feature of sustainable tourism (Obua & Harding, 1996). The activities people carry out and the reasons motivating them to visit natural areas reflects their demands and the needs they seek to be fulfilled (Chiesura, 2004). Acknowledgement of the visitor profile (sociodemographic characteristics such as age, gender, nationality and income) is essential for the understanding of their inherent demands and needs, which are key variables to assist decision makers in developing planning and management strategies based on evidence and that are compatible with true public needs (Roovers et al., 2002). Policies that account for public involvement and include people's preferences and opinions are more likely to be successful once they contribute to a rationalized and improved management of the area motivating public support for the protection of ecosystems (Matsuoka & Kaplan, 2008; Milcu et al., 2013).

However, tourism possibly may be paradoxical (Hillery et al., 2001). General exponential growth in tourist and recreational activities may have negative impacts on environmental quality and irreversible damage on natural resources (Goodwin & Swingland, 1996), which subsequently will also have an effect

on the social and economic level. If not properly managed, excess visitation will degrade the ecology of the ecosystem and also the quality of the recreational experience (Lynn & Brown, 2003; Petrosillo et al., 2007; Spanou et al., 2012). For this reason, a high concern is imposed on monitoring the number and characteristics of visitors but also the adherence and repercussions of any management plan. It would allow managers to detect changes and trends of visitor's activity behavior and adjust the strategic plan if necessary.

Recreational areas worldwide rarely have information about visitation, including who visits, where they come from, the activities undertaken, motivations for visiting, and what visitors care about. Yet, it is mainly locals and frequent visitors' answers to these questions that can provide a wealth of information about sites and changes in them over time. Information about Ria de Aveiro visitors' profile, perceptions, preferences and expectations is rather scarce or even nonexistent. Therefore, management actions for this coastal area would be based on subjective assumptions of visitors' features (Tallis & Polasky, 2009). This coastal lagoon comprises some protected areas due to its high relevance regarding biological and geomorphological features, which elevates the importance of a reliable and grounded management plan. Achieving a full perspective of recreational use for a lagoon such as Ria de Aveiro is challenging, given the scale of the lagoon and the range of recreational opportunities provided. The overall aim is to understand patterns of recreational use, in a qualitative and quantitative approach, providing valuable scientific data to managers and decision makers for the improvement of policy processes (Fletcher, 2014; Obua & Harding, 1996).

In sociological research, one of the main focus concerns the link between visitors' characteristics and their behavior in a vast range of recreation activities (Tarrant & Green, 1999). The assumption within this study is that sociodemographic characteristics of visitors, such as age, gender, nationality and income, influence outdoor recreational experience and that information provided by them can contribute to better manage these areas. The focus of this chapter is to evaluate the visitor profile of recreational users of a coastal lagoon, Ria de Aveiro. The interest is confined to aspects of visitor sociological profile, behavior during the recreational visit and personal interests and opinions. A detailed analysis of the characteristics and behaviors of visitors is provided here as a contribution to understand the differences between municipalities within the Ria, which is *per se* a valuable input into an improved management of an area for both recreational and environmental benefit. This analysis also informs the valuation results generated in the next chapter on econometrics because it is important to understand the visitor profile before the econometric analysis is undertaken so that the econometrics can be viewed in a richer context of human behavior rather than just as statistical results of no human consequence.

II.1.2 METHODS

II.1.2.1 STUDY AREA AND DATA SAMPLING

The information regarding the study area and data sampling is detailed in the Introduction.

II.1.2.2 VARIABLES FOR THE ANALYSIS

Most variables used in this sociological study were directly taken from the survey raw data, however for some questions variables had to be recoded or transformed into new ones in order to better analyze and interpret the results. To better comprehend explanations below see the questionnaire (Appendix 1).

As far as sociodemographic characteristics are concerned just some minor rescales were made. The age ranges were established according to the literature (Almeida, 2004) and the following names were

assigned for simplicity sake: 'young' – 15 to 23 years old; 'young adult' – 24 to 35 years old; 'adult' – 36 to 49 years old; 'middle-aged' – 50 to 64 years old; 'senior' – more than 65 years old. The thirteen classes of household income were reduced into four classes for ease of analysis and interpretation.

Regarding the four most important activities for the group and the four main reasons for visiting the Ria de Aveiro, as a result of the high number of selectable options (19 activities and 12 reasons), they were organized in groups for some of the analysis. For each group of activities and each group of reasons, a dummy variable was created that takes the value 1 when the visitor considered at least one of the activities or reasons included in each group as one of the most important; it takes the value 0 if none of the activities or reasons in the group was selected. The groups of activities were organized as follows: 'land-based nature activities' (camping, picnicking, bushwalking, bird watching, nature study), 'touristic activities' (sightseeing, Ria de Aveiro cultural heritage, Beira Litoral cultural heritage, boat tour/cruise), 'water-based nature activities' (swimming, canoeing/kayaking, boating, water skiing/jet skiing), 'motorized activities' (4 wheel driving, motorbike riding), 'fishing activities' (fishing from shore, fishing from boat), 'hunting activities' (hunting) and 'relaxing activities' (relaxing). The groups of reasons were organized as follows: 'nature-related reasons' (getting close to nature, being close to water), 'social-related reasons' (having quality time with family, catching up with friends), 'leisure-related reasons' (water activities, fishing, outdoor activities, the Ria de Aveiro offers the best combination of activities), 'tourism-based reasons' (enjoying this part of the North Coast, visiting special spots) and 'relaxation-based reasons' ('relaxing, getting away from it all', and 'it is good for my wellbeing').

Most opinion questions were constructed with a multiple choice in Likert scales[3]. Water exchange statements had a scale of 1 to 5, where 1 was totally agree up to 5 which was totally disagree. This scale was inverted for a more intuitive analysis, ending up with a typical 1 to 5 Likert scale from totally disagree to totally agree. Life satisfaction evaluations were made in a 1 to 10 scale from totally unsatisfied to totally satisfied. Since all the five sentences were related with each other and were all concerned overall life satisfaction, they were all grouped together in a scale that revealed good internal consistency (Cronbach's Alpha = 0.841)[4]. A new variable was created with all the parcels of this question by summing the values and dividing them by the number of parcels. The scale was then reduced to a 1 to 5 scale to simplify the analysis, creating a general life satisfaction index. An index to have a perception on how much Ria de Aveiro is special to the visitor was obtained in a similar way. Questions about statements concerning the emotional feeling towards the Ria de Aveiro region were scaled from totally disagree (1) to totally agree (10) and reduced to a 1 to 5 scale. Two statements were collapsed to create the "Ria de Aveiro is special to me" index with good internal consistency (Cronbach's Alpha = 0.948): 'I feel very attached to the Ria de Aveiro region' and 'The Ria de Aveiro region is special to me'. The other statements were not included due to the negative form of the statement being somehow confusing to many people and to the similarity of some statements.

II.1.2.3 DATA ANALYSIS

Sociodemographic characteristics of visitors were identified and explored in order to evaluate the typical user of Ria de Aveiro and the profile of people visiting the site. Information about visitor behavior includes main activities and reasons that motivate them to go to this lagoon; travel mode,

[3] Likert scales are designed to measure attitudes or opinions usually measuring levels of agreement/disagreement in a typical five-level Likert item from 1 (strongly disagree) to 5 (strongly agree).

[4] Before constructing an index, a Reliability Analysis must be done to confirm if the variables are correlated between them. The Cronbach's α must be higher than 0.7 to allow the calculation of the index (Bland and Altman, 1996).

distance and time; trip costs; and visit duration and frequency. Opinion questions asked concerned life satisfaction, current ecological situation of the ecosystem and personal emotional connection to the site. Analysis was undertaken concerning how these variables are dependent on different types of visitors (according to their sociodemographic features), and how the typology of visitors helps to predict activity behavior. To investigate these issues, the analysis relied mainly on the use of descriptive statistics and frequency analyses with categorical data processing methods such as Pearson χ^2-testing (cross tabulation) and nonparametric statistical tests (such as correlations and analysis of variance). For the analysis of the relationship between two variables with two categories each (for example, gender and dummy for retirement), resulting in a 2 by 2 table, the output reported from Pearson χ^2-testing includes an additional correction value (Yates' Correction for Continuity), designed to compensate for an expected overestimation of statistical significance for small data (Siegel, 1956). For all statistical analyses, the software SPSS 23.0 was used and only results with statistically significance level of 5% were reported in this chapter.

II.1.3 RESULTS

II.1.3.1 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE VISITORS

A summary of Ria de Aveiro visitor sociological profiles is presented in Table 1, which includes a total of 386 usable questionnaires. The largest group of respondents is the 36-49 age group (36.3%), followed by the 24-35 age group (27.4%) (Figure 5A). The average age of the respondents was approximately 39.6 years old (S.D. = 14), the median was 38 years old and 10% were retired. In almost half of the groups (48%) there were young people (age <18 years) included. The groups were composed of 2 young people and 2 adults (median values).

Table 1: Overview of descriptive statistics of visitor characteristics. Std Dev: Standard deviation

	Mean [Median]	Std Dev	Frequency (%)
Respondents	386		
Average age (years)	39.6	14.2	
Average income (€)	24 725	23 859	
Groups with young people			48
Retired respondents			10
Multi-destination trips			29
Single destination trips			71
Day trip from home			58
Average distance from home (km)	246	1185.1	
Length of stay (days)	21.6 [2]	75.4	
Length of total holiday (days)	11.3	29.9	
Number of people in the group	5.6	9.4	
Number of adults in the group	4.0 [2]	7.1	
Past visit rate – last two years (number of visits)	21.6	39.5	
Expected visit rate – next two years (number of visits)	16	13.5	

Most people visiting Ria de Aveiro were from Portugal and 15% were foreign visitors, mainly from Europe and especially from Spain (34% of the foreigners). Within the Portuguese respondents most were from nearby, and from these 65% were from the Aveiro district. There were almost the same

number of female and male visitors (52% and 48%, respectively). For the subsample of international visitors only, percentages of genders was similarly distributed (54% female and 46% male).

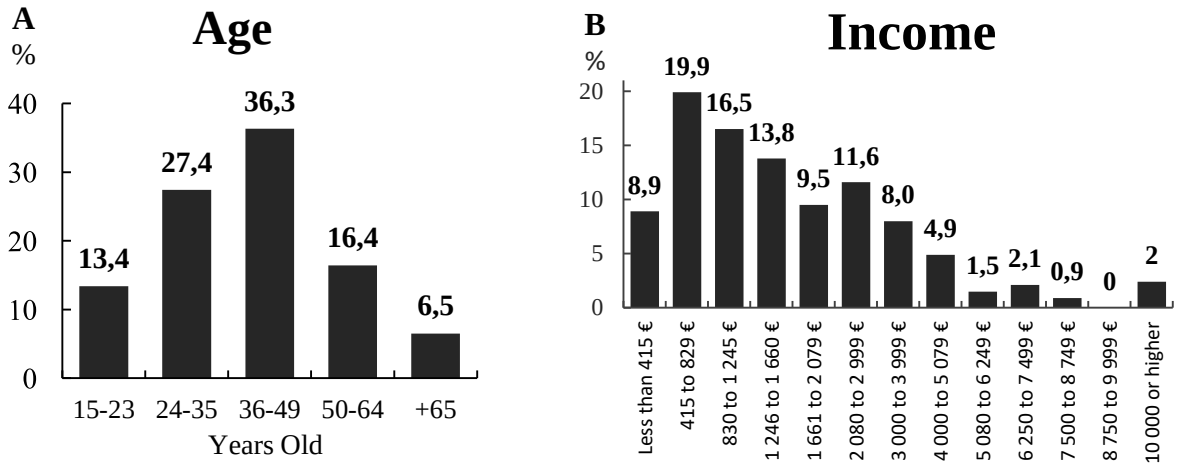

Figure 5: Distribution of visitor percentages (%) per age groups (years old) (A) and per category of income per month (€) (B).

The typical household of the respondents was composed of two adults (> 18 years old) and no young people (< 18 years old). Although half (51.2%) of the visitors didn't have young people in their household, a quarter of them (26.3%) had one minor living with them; another quarter had two or more. Likewise, half of the visitor's households (49.3%) had two adults in their home, 16% had only one, 17% had three adults living together, and approximately another 17% had more than three. The class of income of the household identified more frequently was 415 to 829€ per month, although the mean class of income is 1 246 to 1 660€ per month (Figure 5B). The income was significantly different between the native and non-native visitors (Figure 6A), being the foreign ones wealthier than the locals (χ^2 = 15.679, df = 3, p = 0.001). There was also evidence of substantial differences of wages between genders (χ^2 = 17.524, df = 3, p = 0.001), in favor of men (71.8% of people with incomes higher than 4 000€ per month are men; 72.4% of people with incomes lower than 415€ per month are women) (Figure 6B).

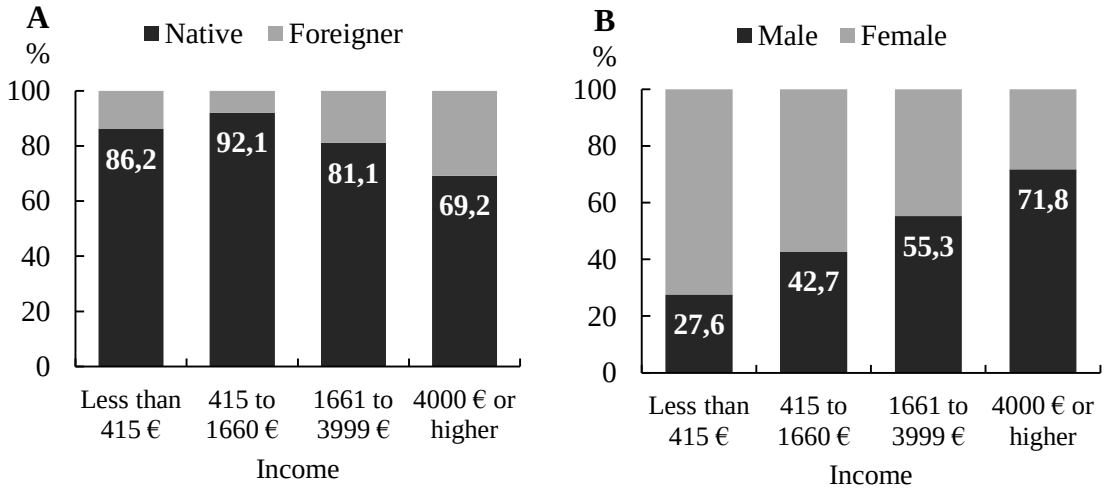

Figure 6: Percentage of visitors (%) per category of income (€) per nationality (A) and per gender (B).

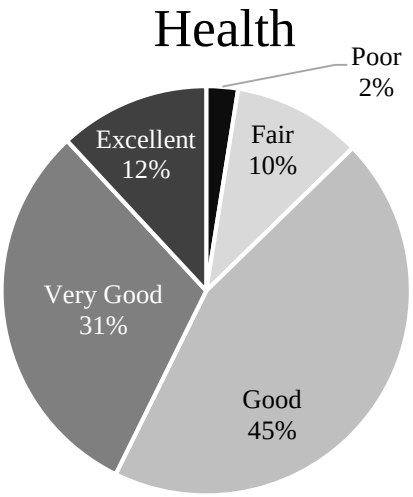

Figure 7: Percentage of visitors' choice of the category that evaluates their personal health.

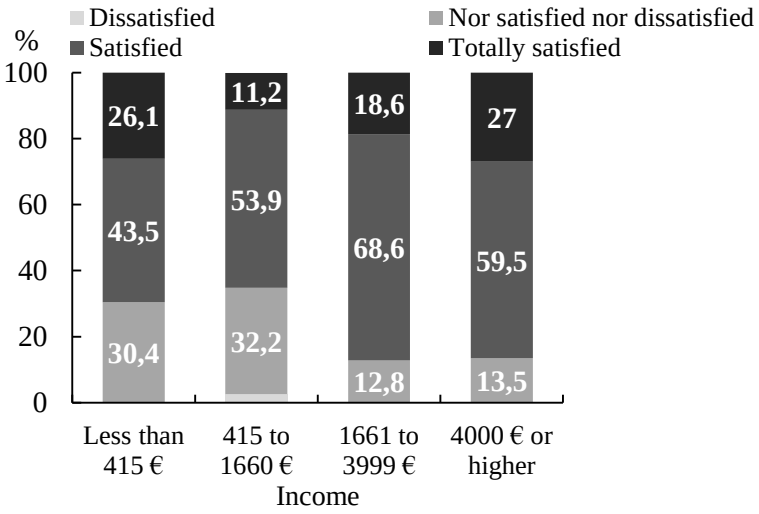

Figure 8: Life satisfaction according to class of income.

The self-evaluation of the personal health (Figure 7) was centered in the intermediate class identified as 'good' (45%), followed by those who consider their health as 'very good' (31%) and then 'excellent' (12%); some considered it just 'fair' (10%) and a few even evaluated it as 'poor' (2%). Overall, the bulk of the visitors (56.8%) was satisfied with their lives, while some (15.7%) were completely satisfied with it; many assumed an intermediate position concerning life satisfaction and there are a few (1.2%) that are dissatisfied. The financial situation evaluation was the one with the more intermediate and negative responses. Not surprisingly, the most satisfied people were the ones with the highest incomes, however, those with the lowest incomes were also more satisfied ($\chi^2 = 24.225$, df = 9, $p = 0.004$) than the ones with intermediate incomes who revealed lower life satisfaction (Figure 8).

II.1.3.2 VISITOR BEHAVIOR

Small cars (engine displacement of less than 2 cm^3) were the most common means of transport used to travel to the site (46.6% of the respondents), followed by people who walked (31.2%). The large car (2 cm^3 or more) was also commonly used (9.8%) while the rest of the respondents travelled by bus, motorbike, jeep, boat and other vehicles. Some recreational users brought some extra equipment on the trip including a tent (7.3%), a boat (6.0%), a caravan (3.4%), a jet ski (1.0%) or a camper trailer (0.8%).

The average distance travelled to the Ria de Aveiro was about 248 km (SD = 1189km), while the median value was 30km, and the average time travelled was around 1h30min (SD = 3.48h), with median value of 40min. Evidently, travel distance and time to reach the lagoon proved to be strongly correlated ($r_s = 0.822$, $p < 0.001$). The large mean distance was the result of the relatively large number of foreign visitors travelling long distances, where the average distance for a foreign visitor was 1,700 kms. The majority of visitors, approximately 60%, were on a day trip from home (Figure 9), around 24% of the respondents stated they were on a holiday where they stayed in Ria de Aveiro at least one night, while the others were either doing a day trip as part of a longer holiday (11%) or just driving past as part of another journey (7%). The common thing to almost all the visitors was that when asked where they had made the decision to go to this specific recreational site, 92% of them said they were at home before they left instead of somewhere else while on the trip.

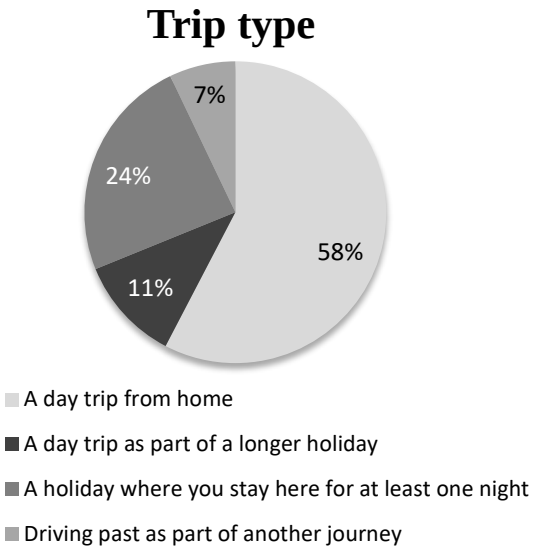

Figure 9: Percentage of visitors doing each type of visit. A day trip from home (58%), a day trip as part of a longer holiday (11%), a holiday where you stay here for at least one night (24%) or driving past as part of another journey (7%).

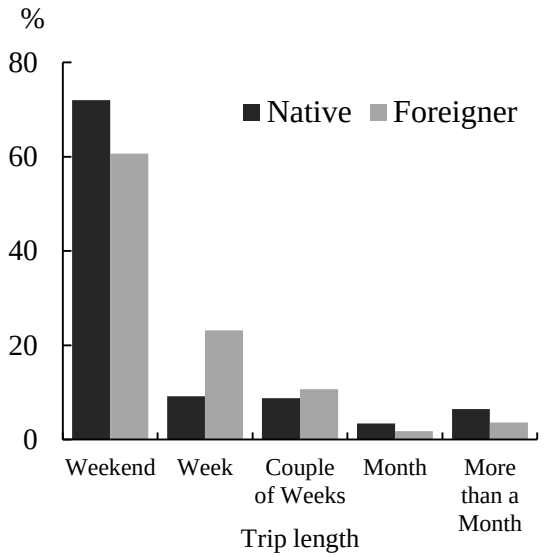

Figure 10: Trip length according to nationality. Percentage of total native and total non-native visitors concerning the maximum number of days they stay in Ria de Aveiro.

The average length of stay in Ria de Aveiro was 21.6 days although the median value was 2 days. In this case, the median value is more appropriate to use rather than the mean because this last one is highly skewed due to some local people reporting 365 days visiting this lagoon. Around 70% of the visitors stayed in Ria up to two days (Figure 10), while 12% stayed up to one week; the rest stayed more than one week. Foreigners stayed longer in the lagoon ($\chi^2 = 9.859$, df = 4, p = 0.043), since there were fewer international visitors staying up to two days (60.7% of the foreigners, 72.0% of the nationals) and more staying up to one week (23.2% of the foreigners, 9.2% of the nationals). Visitors with the highest and lowest incomes were the ones staying longer in the recreational site ($\chi^2 = 21.560$, df = 12, p = 0.043).

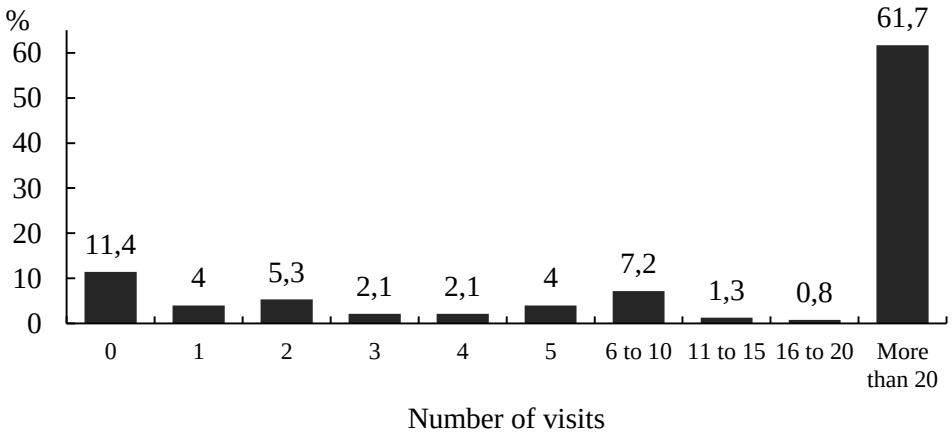

Figure 11: Number of visits to Ria de Aveiro (percentage of response).

The majority of people answering the survey had already visited Ria de Aveiro more than 20 times (62%) while 11% had never come to this site before (Figure 11). As expected, the total number of visits to the lagoon was related to the number of visits in the past two years ($r_s = 0.863$, $p < 0.001$), with 58% of the people who had visited the lagoon over than 20 times, making at least that number of visits in just the last two years. The ordinal number of visits in the past two years is negatively correlated with the

distance travelled from home (r_s = -0.645, p < 0.001) and with the time spent on the trip (r_s = -0.569, p < 0.001).

When asked about future intentions, approximately 61% of the respondents showed interest in visiting Ria de Aveiro more than 20 times during the following ten years; and 79% of these people showed the same interest to visit at this rate in the next two years (r_s = 0.909, p < 0.001). Several hypothetical scenarios were presented to the respondents regarding changes in access to good quality recreation area at the Ria de Aveiro, in which visitors were asked, for each situation, the number of visits they expected to do in the following two years. Five scenarios included an improvement of 10% and 25%, and a degradation of 10%, 25% and 50% in access to recreation areas (Figure 12). The number of visits was significantly different depending on the accessibility conditions (N=189, Friedman test: $\chi^2(5) = 434.575$, p < 0.001). *Post hoc* analysis with Wilcoxon signed-rank tests (see Appendix 3) was conducted and there were no significant differences between the degradation of 50% to the degradation of 25% (Z = 0.561, p > 0.05), between no change and the improvement of 10% (Z = 0.151, p > 0.05) or between the improvement of 10% and the improvement of 25% (Z = 0.545, p > 0.05). However, all the other pairs were significant (p < 0.05), thus there was an overall increase of expected visits for the scenarios with improvement of access and a decrease when the access was degraded.

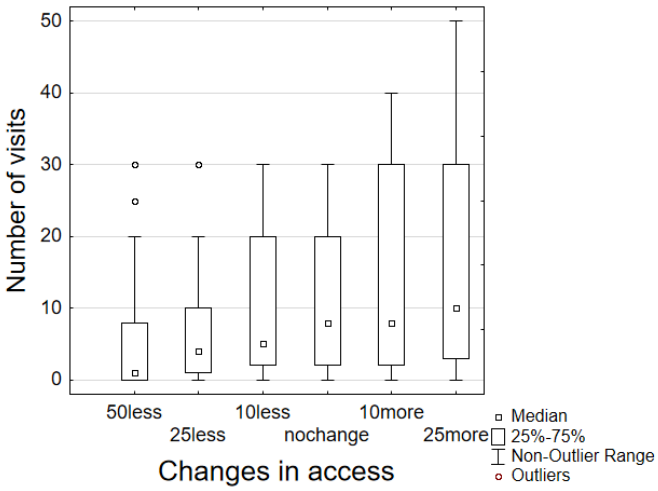

Figure 12: Number of visits to Ria de Aveiro according to changes in access between a degradation of 50% to an improvement of 25%.

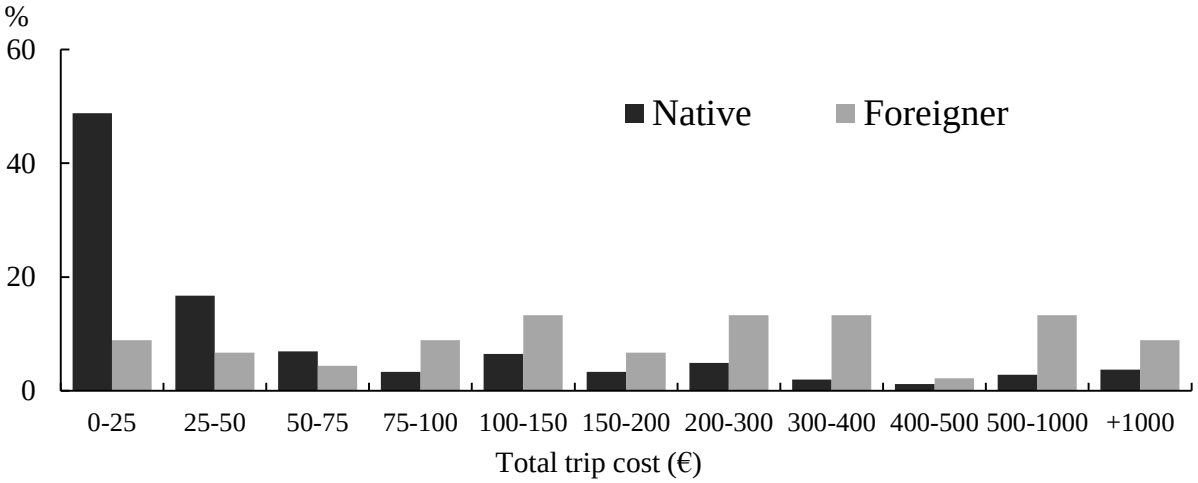

Figure 13: Total trip cost (€) per nationality. Percentage of total native and total non-native visitors relative to each class of total costs.

Almost 60% (N=291) of all recreational users of this coastal lagoon spent less than 50€ in total for their group visit (Figure 13). Nevertheless, the mean cost of the total trip was around 322€ (median=40; N=291), with the mean cost of travel costs around 36€ (median=10, N=254), of food around 119€ (median=30, N=206), of accommodation around 205€ (median=100, N=47) and of other costs (e.g.

alcohol, boat costs, tour costs) around 69€ (median=20, N=68)[5]. These costs weren't affected by visitors' gender or age but were higher for non-native visitors ($\chi^2 = 52.751$, df = 10, $p < 0.001$) and, as expected, for visitors with higher incomes ($\chi^2 = 53.986$, df = 30, $p = 0.005$).

Concerning special areas within Ria de Aveiro, some people particularly liked to use specific areas of land recreation (35.5%), others preferred areas of water recreation (25.7%) and a few visitors identified special camp spots (5.3%); many didn't consider any area as special (33.5%). These preferences significantly changed when considering only the subsample of foreign visitors ($\chi^2 = 27.639$, df = 3, $p < 0.001$), whereas most of them (59.6%) identified no special area for them, and around 12-15% identified special camping, land-recreation or water-recreation areas. In the case of their special areas being closed in future, the majority of those who had special areas would consider going to another part of Ria de Aveiro (53.9%). Almost 25% would choose to go to another similar area on the coast, while the rest would visit another wetland (5.2%), stay at home (6.6%) or do something else (9.9%).

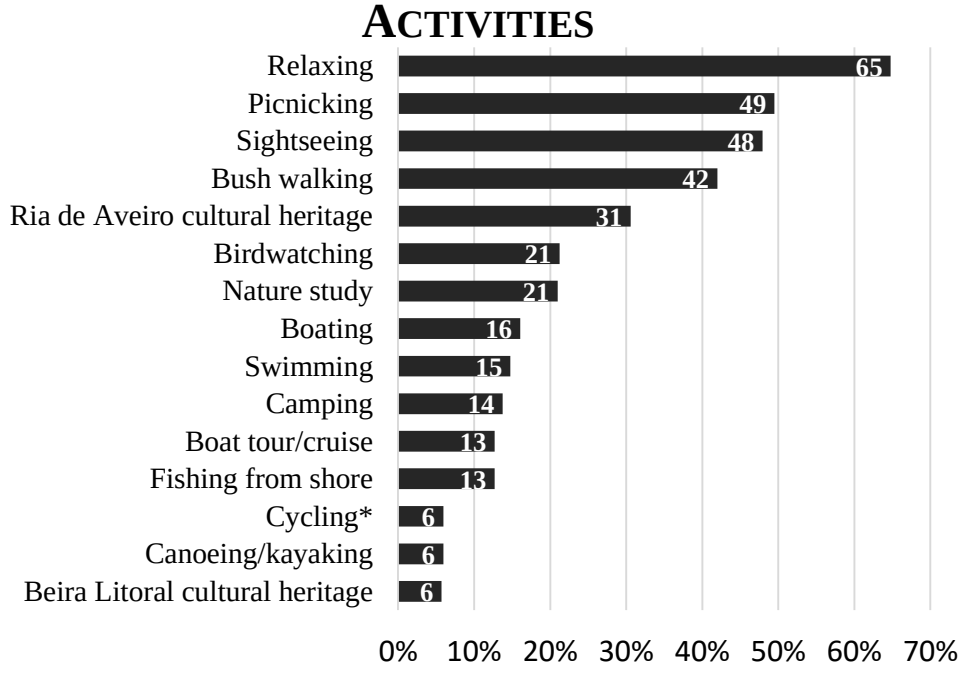

Figure 14: Percentage of visitor's main activities performed in Ria de Aveiro, ranked in descending order. Responses with percentages below 5% were removed from figure. Activities signed with "*" were not part of the selectable options in the survey but were identified by visitors in the blank space for 'other activities'.

People were asked to select the four most important activities at the Ria de Aveiro for the group. Figure 14 illustrates the percentage of people who chose each activity ranked in descending order, with the highest rated options standing out from the rest. The bulk of the visitors appreciated their relaxation time at this site (64.8%), picnicking (49.5%), sightseeing (47.9%) and also bushwalking (42.0%). The cultural heritage of Ria de Aveiro was a big attraction for many visitors as well (30.6%). Nature related activities such as birdwatching (21.2%) and nature study (21.0%) were also amongst respondents' main selected ones. Some water activities (such as boating, swimming and boat tours) as well as camping and fishing from shore were also quite often chosen by the visitors as important activities they undertook at this lagoon (from 13 to 16% each activity). Some activities such as canoeing, Beira Litoral cultural heritage, fishing from boat, motorbike, water skiing, hunting and 4 wheel driving were barely chosen.

[5] To be noted that some people haven't reported the costs of each parcel and only did it for the total costs. For those who reported just for the parcels, calculations were made to evaluate the total costs.

Cycling was not one of the options available for respondents to select, however since there was a blank space to fill with 'other activities', 6% of the people surveyed stated this as one of the four main activities. This percentage would be expected to be higher if cycling was one of the selectable activities because this activity may have been one of the most important ones for some visitors but since it was not an option they didn't bother to state it in 'other activities' and may have chosen another one instead. Some water activities may also be slightly biased due to constraints in approaching these types of respondents, since they may have been inside the lagoon and the survey was applied on land.

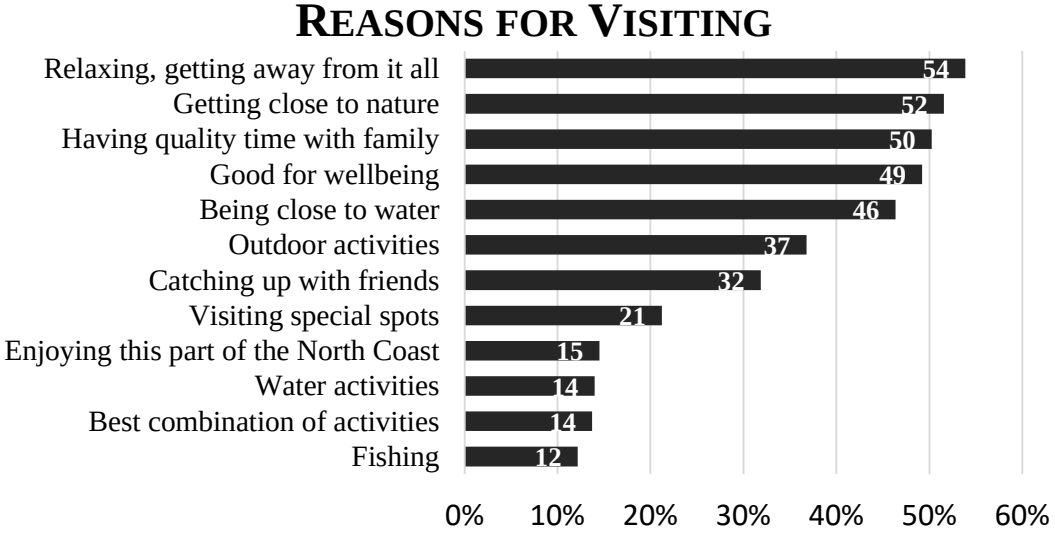

Figure 15: Percentage of visitor's main reasons to visit Ria de Aveiro, ranked in descending order.

Figure 15 shows that visitors' main reasons for visiting this recreational site were the relaxation offered by the environment and the chance of 'getting away from it all' (53.9%), followed by the ability to get close to nature (51.6%), and having quality time with family (50.3%). The perceived wellbeing (49.2%) and the proximity to water (46.4%) during the visits were two main motivations to visit, which were related to the opportunity to enjoy being embraced in natural assets. Some important reasons that drove people to this lagoon was the opportunity to carry out some outdoor activities (36.8%), the chance to catch up with friends (31.9%) and to visit special spots (21.2%). Other reasons also reasonably chosen by visitors included the will to enjoy this part of the North Coast (14.5%), to do water activities (14.0%), because Ria de Aveiro offered the best combination of activities (13.7%) and to fish (12.2%).

II.1.3.3 VISITOR OPINIONS

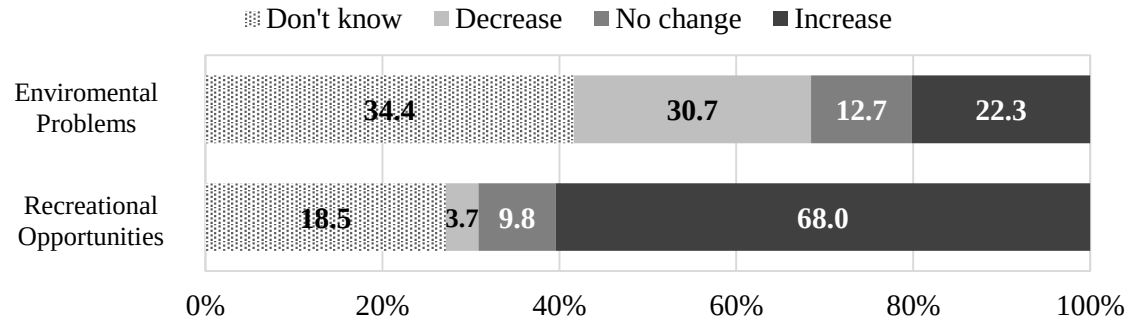

Figure 16: Opinion about current trends of environmental problems and recreational opportunities when comparing with a few years ago (only Portuguese visitors).

A couple of questions on the survey sought to evaluate the situation about the recreation opportunities and the environmental problems of Ria de Aveiro in comparison with a few years ago (Figure 16). Foreign visitors were not aware of either the evolution of the recreation opportunities (79.6%) nor of the environmental problems (85.2%). Thus only Portuguese users' responses were taken into account to understand their perception of the current situation (Figure 16). Most native visitors (68.0%) clearly considered that the recreation opportunities had been increasing, while only 3.7% thought they have been decreasing; a considerable amount of people admitted they did not know (18.5%) and the rest (9.8%) though that it had stayed much the same. Concerning the environmental problems the opinions differed more, with a high number of people (30.7%) believing they had been diminishing, although many (22.3%) thought that they increased compared to the past few years; the majority (34.4%) recognized they had no knowledge about it and some visitors (12.7%) stated conditions had not changed much. Visitors were then asked to specify, in an open-ended question, which environmental problem was mostly present and around 70% mentioned pollution (mainly water pollution) and almost 30% mentioned siltation as an important problem; a few identified overfishing.

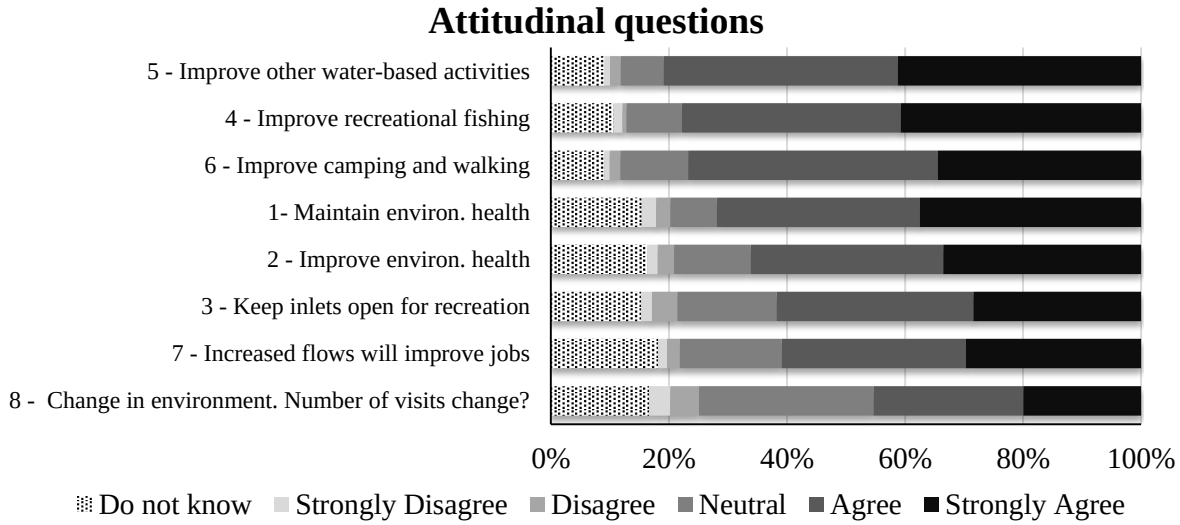

Figure 17: Attitudinal questions regarding to water exchange through the inlets and its effect on the environment and recreation.

People were asked their opinion on some statements about water exchange through the lagoon inlets that can be managed specifically to address environmental 'health', including plant and fish health and also feeding and breeding conditions of water birds (Figure 17; for more detail, see Appendix 2). The question with a higher neutral position (25.4%) was indeed the one asking if the number of visits would change in response to changes in the environmental features, although the way the question was made was challenging and may not have been clear. Statements about the positive effects of the better environmental health on recreational activities, both water and land-based activities, were straightforward and the ones that visitors more uniformly agreed on. Although with a higher percentage of people revealing that they did not know, people also tended to agree that additional water exchange through the inlets was essential to maintain and even improve environmental health. Yet with the majority agreeing, the question that states that additional water exchange should be managed to keep the inlets open for recreation raised some neutral positions and even some disagreements. Similarly, most people agreed but some assumed they didn't have much knowledge and took some neutral positions about the improvement of jobs in aquaculture-related sectors due to an increased water exchange through the inlets. Overall, the majority agreed with each sentence,

whereas the median value for every single sentence was 4 (the class of 'agree'), and 44.4% of people agreed or strongly agreed with all statements (see Appendix 2).

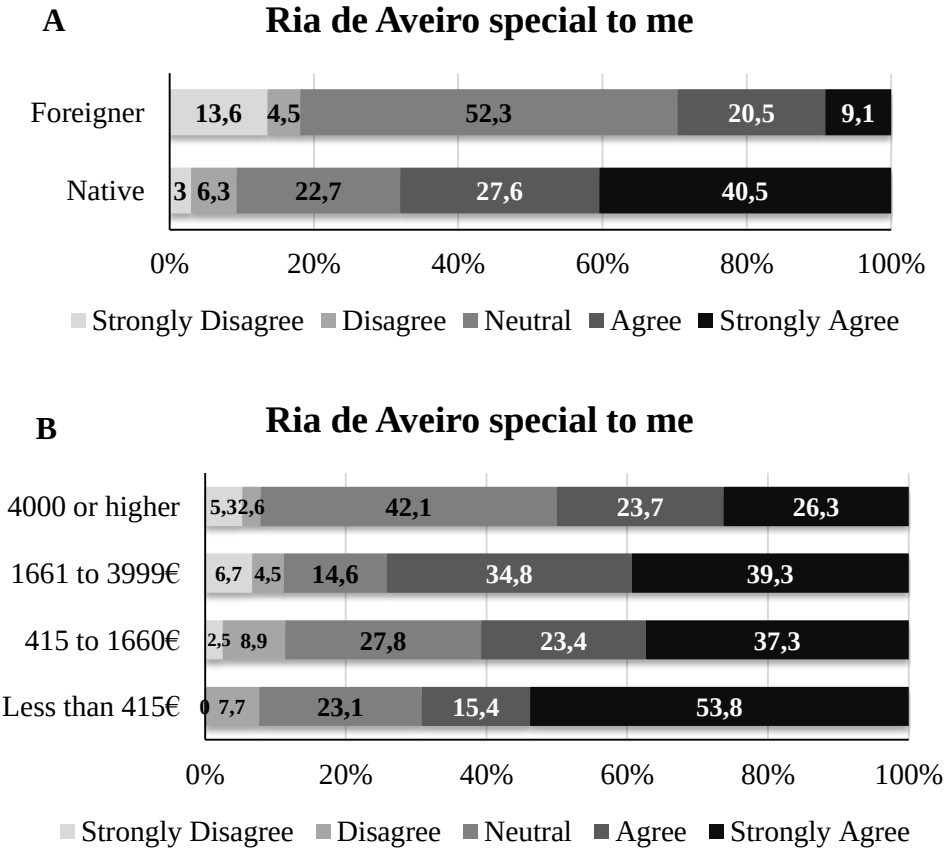

Figure 18: 'Ria de Aveiro special to me' index according to nationality (A) and class of income (B).

Regarding the index created for how Ria de Aveiro is special to the visitor, a substantial amount of people (59%) feels very attached to the Ria de Aveiro region, although some even disagree with the sentence (14.4%). Likewise, most visitors consider this region as special to them (63.6%), many are indifferent (24.6%) and some don't have a special connection to the region (11.8%). The index of how Ria de Aveiro is special to the visitor is associated with the nationality ($\chi^2 = 34.171$, df = 4, $p < 0.001$), with half of the foreigners (52.3%) being in a transitional position to their 'emotional' connection to this specific site, while 68% of Portuguese visitors feeling connected or very connected towards this ecosystem (Figure 18A). The income variable also has an impact regarding this factor ($\chi^2 = 22.641$, df = 12, $p = 0.031$), since the less wealthy visitors feel more attached (agree and strongly agree) to the area (69%) than the wealthier ones (50%) (Figure 18B). The non-native visitors and the ones who went to Ria mainly for tourism reasons have a significant relationship with their response on how attached they feel to the region ($\chi^2 = 21.296$, df = 4, $p < 0.001$). The number of visitors coming to this site for tourism reasons decreases as the Ria de Aveiro is considered more special to the visitors ($r_s = -0.235$, $p < 0.001$), i.e., people that feel more connected to this lagoon tend to come less for the purpose of tourism.

At the end of the survey, there was a blank space where people could write comments. Only a few people (N=52) were keen to leave their comments and these were organized through similarities of words used and ideas. The theme most reported was 'The survey is too long and/or confused'. Yet the second most frequent comment was 'Thanking or complimenting the survey'. Then, some of them

complained about the 'Pollution' and that 'The survey is inadequate for local people'. Visitors also showed desire for 'More recreation activities' and 'Better management of the area and more facilities'. Some even asked for 'More information on the site' and emphasized the 'Dredging' issue.

II.1.3.4 DETERMINANTS OF BEHAVIOR IN CONTEXT

Visitor's characteristics, opinions and behaviors are all sources of information relevant for better management of the area. Nonetheless, what may be more interesting and useful for decision makers is how all these variables interact with each other. It is important to perceive if there is any relationship between visitors' activities and reasons to visit this site and their sociodemographic features. Additionally, the Ria de Aveiro ecosystem has different habitats within different municipalities which may provide different attractions to visitors. This results in a differentiation of the type of visitors as well as activities enrolled and motivations for visiting each municipality. These types of analyses are presented below.

Most Important Activities

For simplicity purposes, activities and reasons were organized and analyzed as groups of activities (see composition of the groups in section Methods). The groups of activities more frequently selected were, in descending order, land-based nature activities (79.3% of visitors), relaxing activities (64.8%), touristic activities (59.6%), water-based nature activities (30.6%), fishing activities (14.5%), motorized activities (3.9%) and hunting activities (2.6%). These groups' percentages are based on the people who selected at least one of the activities included in each group as the main ones developed in this lagoon, and thus they are dependent on the number of activities included in each group. Even so, it is clear that the last two groups (motorized and hunting activities) are underrepresented and, for that reason, are not further explored.

The type of activities practiced in the lagoon are naturally different from person to person according to their sociodemographic characteristics that may condition and/or influence the choice of the main activities. Starting with the most frequent group of the land-activities related to nature, there is no statistically significant difference between visitors' gender, age group, retirement status, nationality (being foreigner or native) and income. Likewise, the water-based nature activities are uniformly distributed among the different visitors' characteristics.

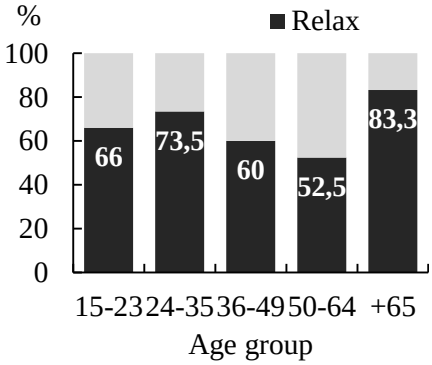

Figure 19: Visitors percentages in each age group according to selection of the relax activity.

Concerning relaxation (Figure 19), the age groups with a higher percentage of people who chose relaxing as a main activity compared to those who didn't choose this option (χ^2 = 12.487, df = 4, p = 0.014), is the senior group (+65 years old: 83.3%) and the young adult's group (24-35 years old: 73.5%); the age group with the lowest percentage was the middle-aged group (50-64 years old: 52.5%). The other variables did not have a statistically significance relationship with this activity.

Touristic activities (Figure 20) were explicitly preferred by the foreign visitors (χ^2 = 22.215, df = 1, p < 0.001), as 89.3% of them selected tourism-related activities, than by the national visitors with no

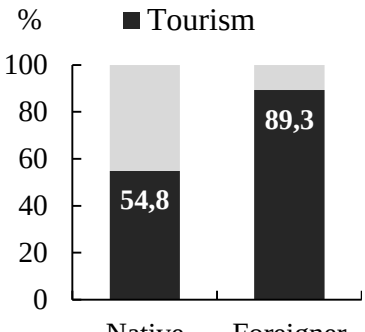

Figure 20: Visitors percentages of natives and non-natives, according to selection of touristic activity.

more than half of them making tourism (54.8%). None of the other sociodemographic characteristics had influence on the choice of touristic activities.

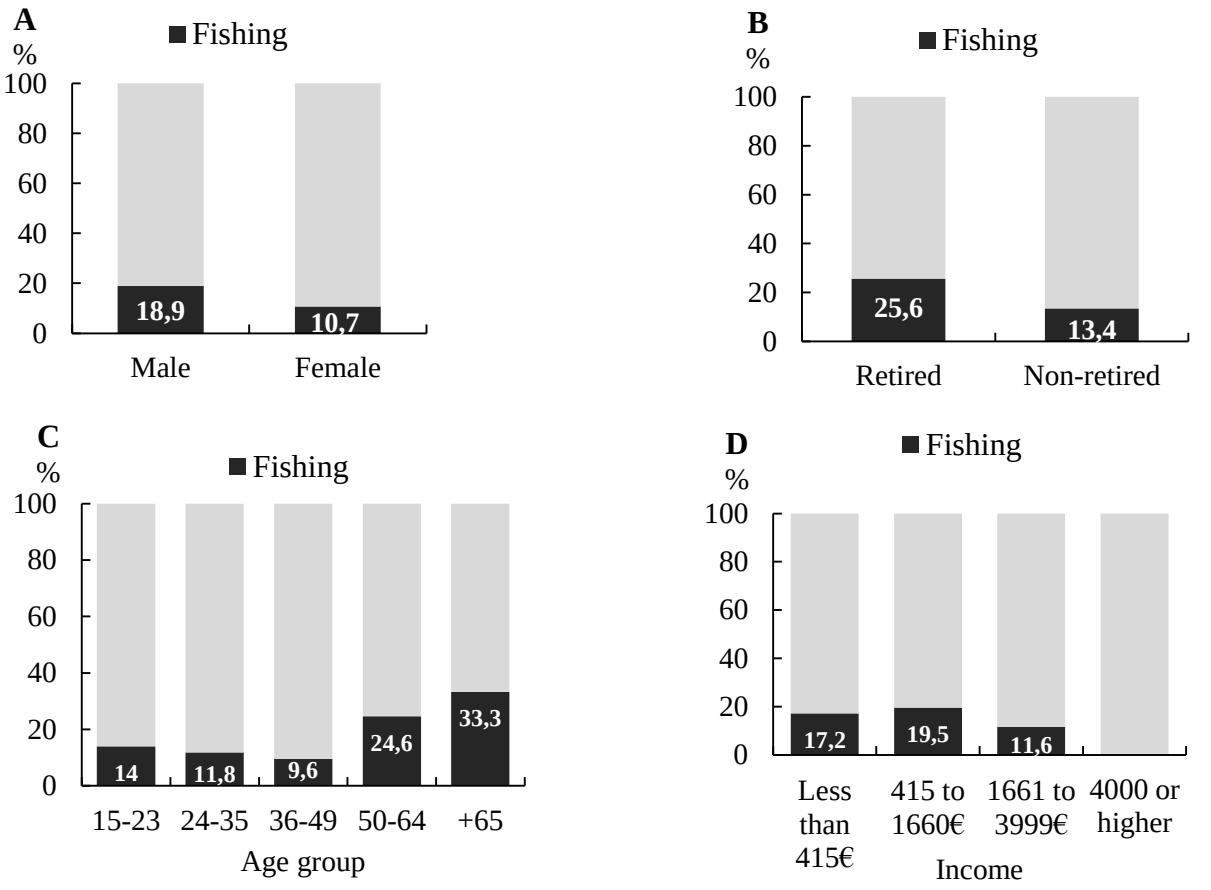

Figure 21: Visitors percentages of each gender (A), retirement status (B), age group (C) and class of income (D), according to selection of the fishing activity.

Fishing (Figure 21), either from boat or from shore, was an activity that typically men chose more often (χ^2 = 4.388, df = 1, p = 0.036) than women (18.9% of men and 10.7% of women); that older middle-aged chose (50-64 years old: 24.6%) and senior (+65 years old: 33.3%) chose more often (χ^2 =14.819, df = 4, p = 0.005) than younger groups; less wealthy people practice fishing more often (χ^2 = 10.650, df = 3, p = 0.014), such that around 20% of those visitors earning less than 1 660€ per month (both the class 'less than 415€' and the class '415 - 1 660€') chose fishing as one of the main activities, whereas only around 12% of the ones gaining 1 661 – 3 999€ per month chose this option, and absolutely none of the wealthier visitors (gaining more than 4 000€ per month) fish.

Most Important Reasons for Visiting

The groups of reasons more frequently selected for visiting were, in order, relaxation-based reasons (75.1% of visitors), nature-related reasons (73.8%), social-related reasons (64.8%), leisure-related reasons (57.8%) and tourism-based reasons (30.8%). Likewise, these groups' percentages are based on the people who selected at least one of the reasons included in each group as the main ones to visit this lagoon, and thus they are dependent on the number of reasons included in each group.

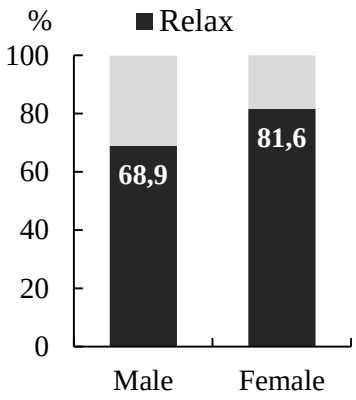

Figure 22: Visitors percentages in each gender, according to selection of the relax reason.

The reasons that motivated people to visit Ria de Aveiro were as well dependent on each person and on the sociodemographic characteristics each one presented. Relaxation based-reasons seems to have a greater importance for women (χ^2 =7.570, df = 1, p = 0.006), since around 82% of female visitors chose relaxation or improvement of wellbeing, as opposed to 69% of the male visitors choosing this type of reason (Figure 22). The gender was the only variable influencing this group of reasons. As for nature-related reasons, there was no significant evidence of differences among different gender, age, retirement status, nationality or income.

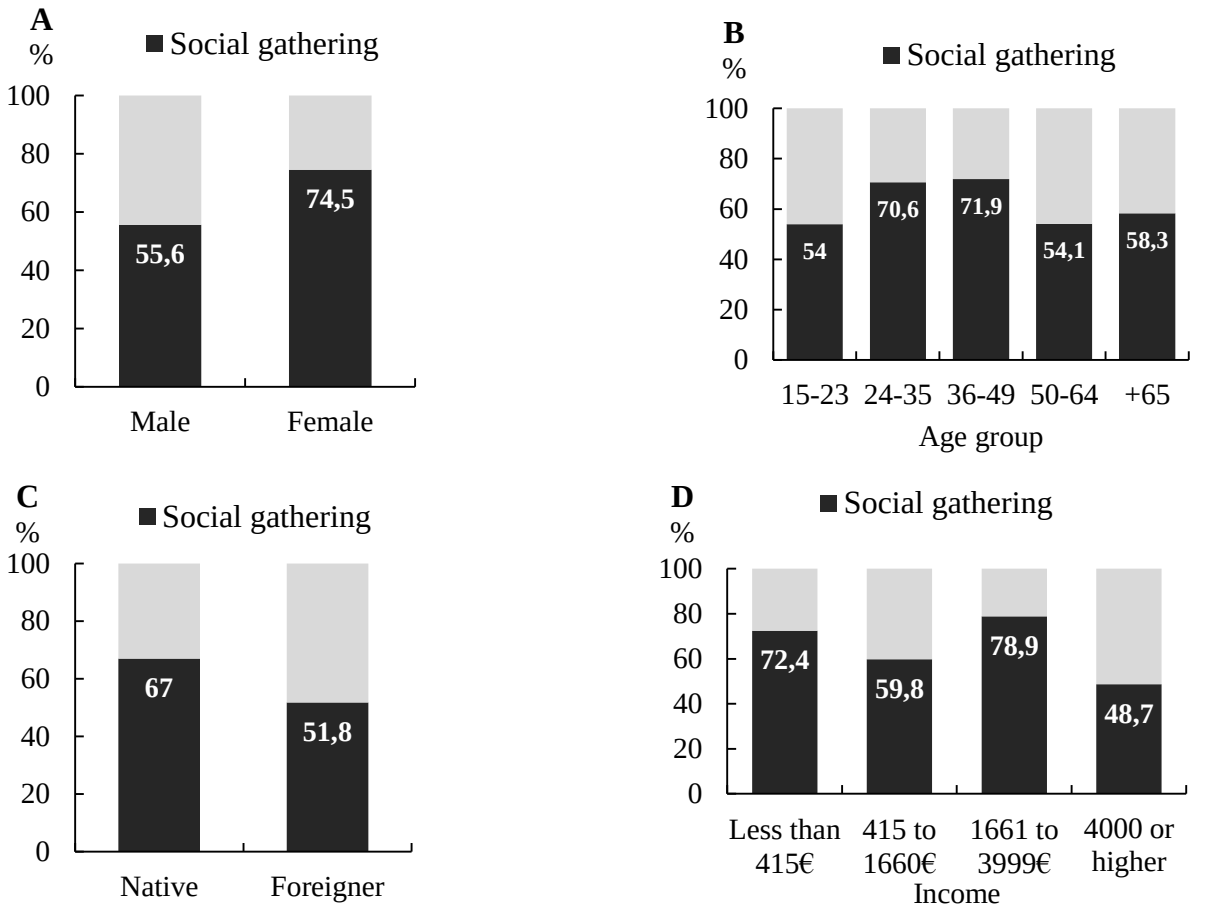

Figure 23: Visitors percentages of each gender (A), age group (B), nationality (C) and class of income (D), according to selection of the social reasons.

In contrast, the reasons related to social gathering showed statistical differences considering all demographic variables, except for the retired dummy variable (Figure 23). There is a significant association between the gender of a visitor and the selection of social-related reasons as the main important ones (χ^2 =14.046, df = 1, p < 0.001), with three quarters of the women surveyed (74.5%) driven by the chance to catch up with family and friends but only nearly half of the men surveyed chose the same reason. Regarding the age group the young adults (24-35 years old: 70.6%) and the adults (36-49 years old: 71.9%) picked more frequently the social-related reasons (χ^2 = 10.529, df = 4, p = 0.032). As expected, foreigner visitors don't come to Ria de Aveiro to visit friends and family as much as

Portuguese visitors do (χ^2 = 4.195, df = 1, p = 0.041), as 67% of local people chose this as a main motivation for the visit and a still reasonable amount of around 52% of non-native visitors. The household income also has some influence on the selection of this type of reason (χ^2 = 15.376, df = 3, p = 0.002), where the group of people earning below 4 000€ per month has around 60 to 79% visitors choosing social-related reasons, however less than a half (48.7%) of those gaining above 4 000€ per month chose these reasons.

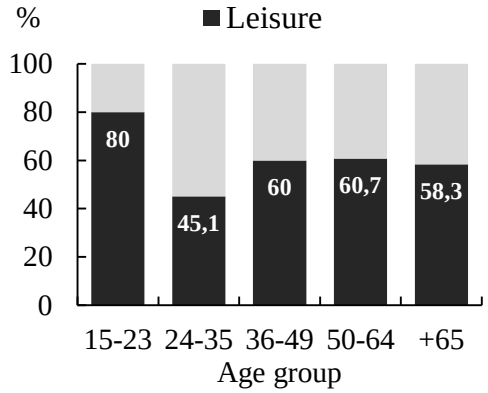

Figure 25: Visitors percentages of each age group, according to selection of the leisure activities reasons.

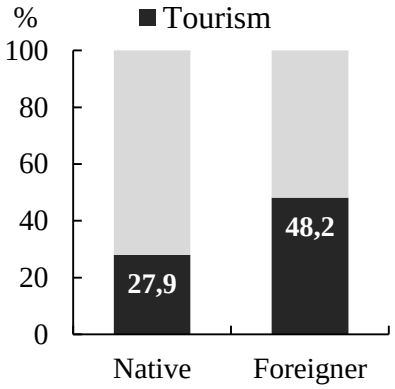

Figure 24: Visitors percentages per nationality, according to selection of tourism reasons.

Those reasons related to outdoor leisure activities are associated only with the age groups (χ^2 = 17.319, df = 4, p = 0.002), naturally having a large amount (80.0%) of young people (15-23 years old) choosing this type of reason (Figure 25). Finally, the touristic reasons are, with no other association with sociodemographic variables, of major importance for foreign visitors (χ^2 = 8.355, df = 1, p = 0.004), with almost 50% of non-native respondents coming for the purpose of tourism, almost twice as much as the response for the native respondents this (Figure 24).

Municipalities

There are four main municipalities in Aveiro district, where the survey was applied, that surround the Ria de Aveiro lagoon: Aveiro (N=141), Estarreja (N=50), Ílhavo (N=124) e Murtosa (N=71). These municipalities have different characteristics and attractions to offer to visitors, hence they are significantly related to some features of the respondents and also to some of the activities people practice and reasons that motivate people to go to the lagoon.

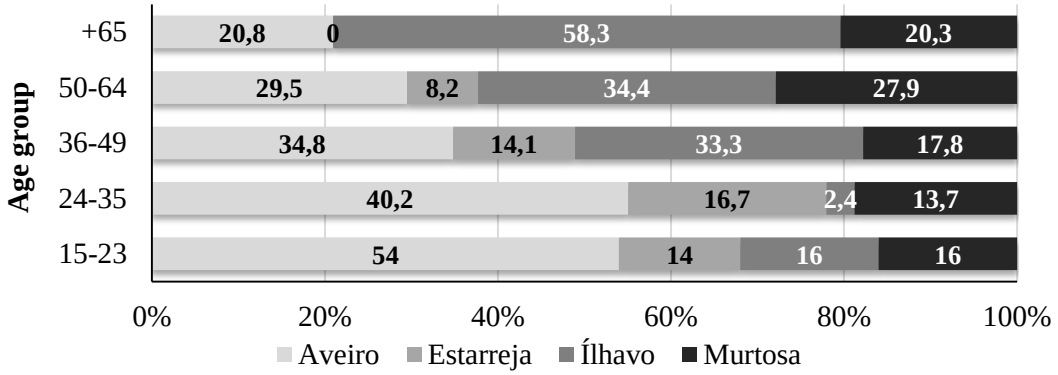

Figure 26: Visitors percentages of each age group, according to the municipality where they were approached.

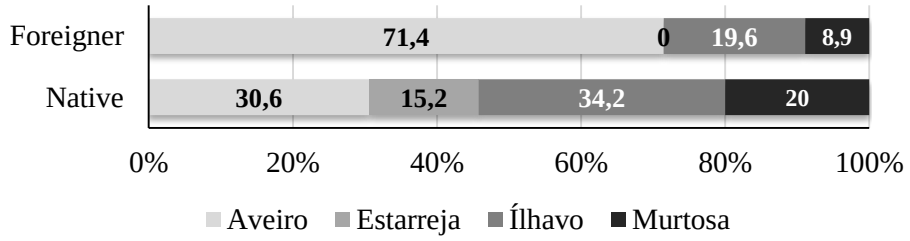

Figure 27: Visitors percentages of natives and foreigners, according to the municipality where they were approached.

Municipalities proved to be statistically associated with the age groups (χ^2 = 26.566, df = 12, p = 0.009) and nationality (χ^2 = 36.693, df = 3, p < 0.001). From the youngest age group (Figure 26), it was found that more than half of them (54.0%) were encountered in Aveiro city and around 15% were visiting one of the other municipalities; young adults and adults were also found very often visiting Aveiro (40.2 and 34.8%, respectively) but also Ílhavo (29.4 and 33.3%); for older age groups, as for middle-aged people and seniors, visiting preferences were observed to be for Ílhavo (34.4% and 58.3%, respectively) and Murtosa (27.9 and 20.8%). Foreigners visitors were mostly (71.4%) found in Aveiro municipality and some in Ílhavo (19.6%) and Murtosa (8.9%), in contrary to national respondents found mainly in Ílhavo (34.2%), followed by Aveiro (30.6%), then Murtosa (20.0%) and finally Estarreja (15.2%) (Figure 27)[6].

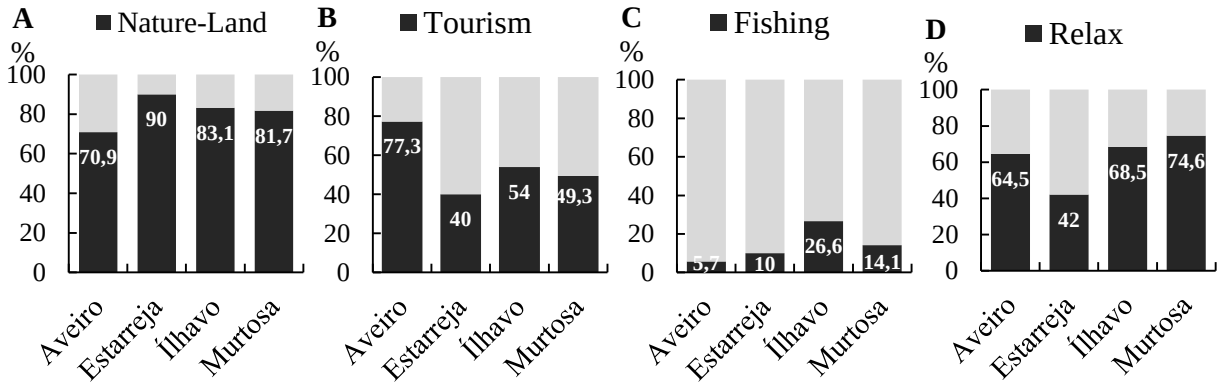

Figure 28: Visitors percentages of each municipality, according to selection of land-based nature activities (A), tourism activities (B), fishing activities (C) and relaxation activities (D).

Almost all visitors (90.0%) approached in Estarreja identified at least one activity of the land-based nature activities (χ^2 = 10.824, df = 3, p = 0.013), whereas in Aveiro this percentage was the lowest (70.9%) (Figure 28A). In contrast, in Aveiro municipality almost 80% of the people chose touristic activities while in the other municipalities there was as many people doing tourism as the ones not doing it (χ^2 = 31.113, df = 3, p < 0.001) (Figure 28B). As for fishing, the most important municipality for this activity is Ílhavo (26.6%) and then Murtosa (14.1%); the other two municipalities had just a few visitors choosing to fish (χ^2 = 24.351, df = 3, p < 0.001) (Figure 28C). Lastly, the activity of relaxation was also significantly different among the municipalities (χ^2 = 15.175, df = 3, p = 0.002). with a higher percentage of people selecting it as one of the main important activities (64.5% in Aveiro to 74.6% in Murtosa) than the people not choosing it, except for Estarreja (42.0%) (Figure 28D); Estarreja was also the municipality with least observations (N= 50) that may influence the percentages.

[6] The amount of people surveyed in each municipality was different: Aveiro (36.5%), Ílhavo (32.1%), Murtosa (18.4%) and Estarreja (13.0%).

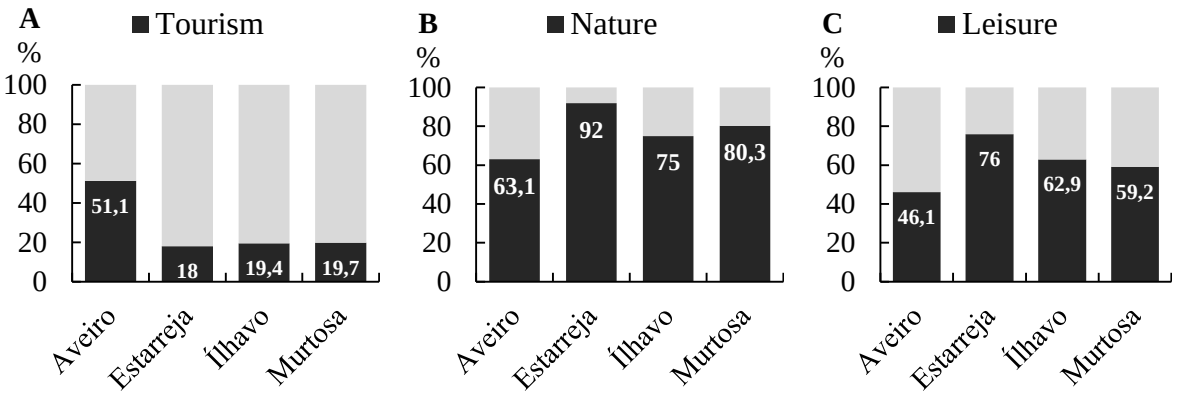

Figure 29: Visitors percentages of each municipality, according to selection of tourism reasons (A), nature reasons (B) and leisure activities reasons (C).

Regarding the main reasons that drive people to visit this central lagoon the municipalities have some influence as well. As expected, the amount of people visiting mainly for touristic purposes is statistically higher (χ^2 = 42.698, df = 3, p < 0.001) in Aveiro (51.1%) than for the rest of the municipalities (18.0% in Estarreja to 19.7% in Murtosa) (Figure 29A). Nature-related reasons are of major importance in Estarreja (χ^2 = 18.533, df = 3, p < 0.001) since almost all visitors (92.0%) have chosen this kind of reason as a motivation to visit Ria de Aveiro, followed by people in Murtosa (80.3%), in Ílhavo (75.0%) and finally in Aveiro (63.1%) (Figure 29B). For all municipalities there is a considerable amount of people choosing to go to this lagoon to enjoy leisure activities, however this may seem to have had a stronger impact for people surveyed in Estarreja (76.0%) and not so strong in Aveiro (46.1%); for the other municipalities, around 60% came mainly to practice this activity (χ^2 = 16.079, df = 3, p = 0.001) (Figure 29C).

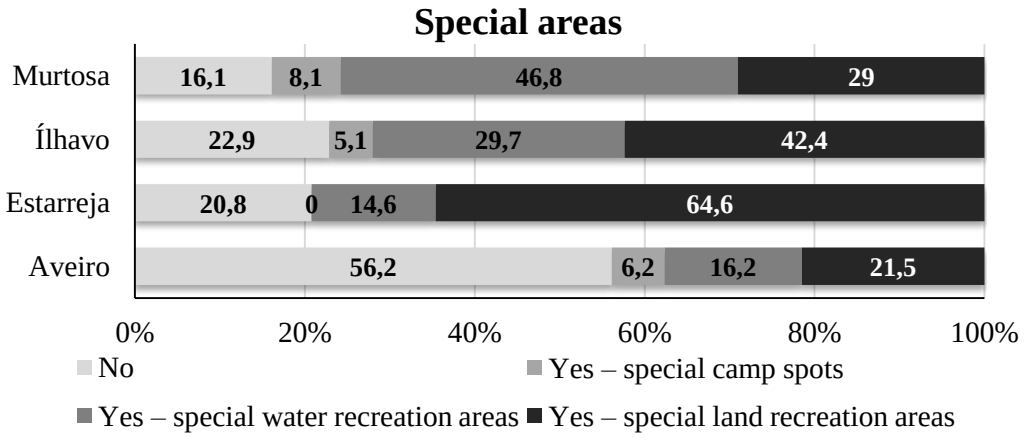

Figure 30: Special areas within each municipality.

The areas people consider special to them and that they particularly like to use are different from municipality to municipality (χ^2 = 74.618, df = 9, p < 0.001) (Figure 30). The majority of people surveyed in Aveiro municipality revealed no special area (56.2%), although some have special water (16.2%) and special land (21.5%) recreation areas. In Estarreja special land recreation areas prevailed (64.6%), although some special water recreation areas have also been identified (14.6%). Identically, Ílhavo municipality was characterized mainly by land (42.4%) and water (29.7%) recreation areas that were special to visitors. Inversely, in Murtosa more people selected special areas related to water recreation (46.8%) even though many visitors selected areas related to land recreation (29.0%). A minor

percentage of people considered special areas for camping (8.1% of people surveyed in Murtosa, 6.2% in Aveiro and 5.1% in Ílhavo).

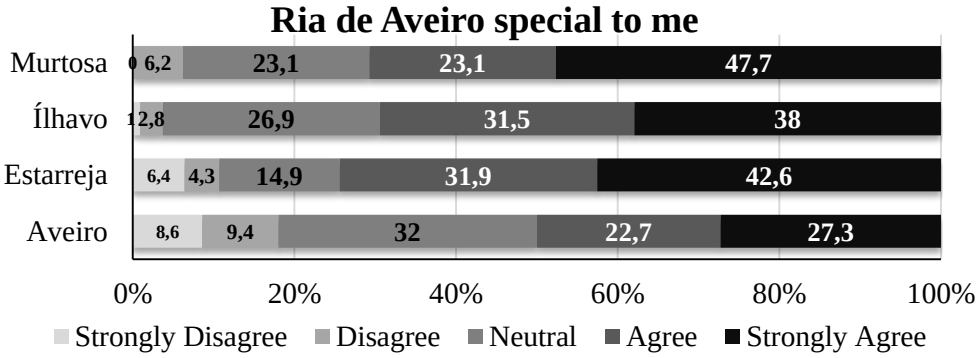

Figure 31: 'Ria de Aveiro special to me' índex within each municipality, in percentage of responses.

Visitors that felt more attached to Ria de Aveiro (agree and strongly agree) were less likely to be found in Aveiro ($\chi^2 = 28.482$, df = 12, p = 0.005), where there was the highest share of foreign visitors and where there was less preference for 'special' areas as noted above, with 50% of people considering the lagoon special to them, and more found in municipalities such as Estarreja (74.5%) and then Murtosa (70.8%) and Ílhavo (69.5%) (Figure 31).

II.1.4 DISCUSSION

II.1.4.1 TYPICAL VISITOR PROFILE

Socio-demographic characteristics of Ria de Aveiro's Portuguese visitors were compared with national statistics obtained through the population census. Data were found to be relatively similar to national averages. For example, the average Portuguese visitor age was 39.4 years and the national value is 43.1 years old (PORDATA, 2014). The percentages of female and male visitors are 52% and 48%, respectively, and the ones obtained through population census are 53% and 47% (INE, 2015). In Portugal, 11.9% of the population is retired (INE, 2015) and the percentage of retired visitors was of 10%. This information provides evidence that the distributions of some main sociodemographic variables (sex, age) match with the ones for the national averages, which means that the sample is fairly representative of Portuguese population. It also suggests that this area receives visitors that reflect a good cross section of the general population. This would further suggest that the preferences and values may be representative of the general population although a survey of the general population and statistical comparison would be needed to assure confidence of the similarities.

The typical visitor is a Portuguese female adult around 40 years old with relative low income and the typical group has 2 adults and 2 young people. The majority of the recreational users were locals living within the Aveiro district, and essentially doing a day trip from home. Distances to a recreational site is associated with the frequency rates of visitation, whereas the closer the recreational site is to an individual's home, the higher the number of visits that the individual makes (Schipperijn et al., 2010; Roovers et al., 2002). Many visitors were walking through Ria de Aveiro although most of them chose to travel mainly by car, which is reasonable given the distances to reach different areas around the lagoon (it is 45 kilometers of length and the average distance from home was 246 kilometers). Visitors tend to stay in this recreational site around 2 days and spend less than 50€ on the trip. Foreign respondents, who are generally wealthier, opted to spend more time and more money, which makes sense given the considerable costs for reaching the site.

II.1.4.2 RIA DE AVEIRO COASTAL LAGOON

The main features that attract different people to visit Ria de Aveiro are summarized below in descending order of relevance. Relaxation is clearly the main activity visitors choose to do in Ria de Aveiro, followed by activities such as picnicking, sightseeing, bushwalking, cultural heritage, birdwatching and nature study, which is reasonably similar to many recreational sites across the world (e.g. Chiesura, 2004; Nyaupane et al., 2003; Rolfe and Dyack, 2010).

Relaxing Environment. The natural environment of a coastal lagoon is prone to a high quality relaxing time that many people seek for their holidays or weekends, what was evident from visitors' responses. Relaxing in nature and getting away from it all contributes to mental and physical relaxation and for the overall sense of human well-being. It is an opportunity increasingly appreciated in today's society that allows an escape from the hectic life style of the city (Chiesura, 2004). Generally, natural assets (such as water and vegetation) and environments decrease stress and provide tranquility and peaceful feelings, which are especially beneficial near urban areas (Kaplan, 2001; Schroeder, 1991; Ulrich, 1981). This suggests that management efforts should focus on maintaining areas far from traffic and avoid urbanizing zones.

Contact with Nature. Nature-related activities, mainly land-based activities, as well as nature-related reasons for the visit are also of major importance in this recreational site. Activities and reasons related to nature have no significant interaction with visitor's characteristics, meaning that they are

commonly preferred by all kind of respondents (Drábková, 2012). This motive indicates the necessity and pleasure that people obtain when feeling nature around, embraced by natural assets and experience their elements (Chiesura, 2004). Preservation of natural environment is then crucial for the availability of this outdoor experience that attracts people to this coastal lagoon.

Outdoor Activities. This coastal habitat provides conditions for visitors to practice diverse outdoor recreations activities, both on land and on water. Natural landscape enhances the recreational use of outdoor areas (Coley et al., 1997). There are activities like bushwalking, picnicking, swimming, and others, that are freely available to people given the existence of good ecological conditions of the coastal ecosystem. Other activities such as boating, canoeing, water skiing, and so on, are made possible by the habitat conditions but require additional recreation facilities. The reason for coming to Ria de Aveiro for practicing recreational activities is also highly represented and of greatest relevance for the youngest age group considered since they visit this natural areas to practice outdoor activities more than for any other purposes.

Social Gathering. Although social gathering type of reasons is responsible for bringing half of the foreigner visitors, this visit purpose is evidently more emphasized for national visitors, as many come to visit local relatives or friends but also to spend quality time catching up with friends. Natural areas are associated with important social functions, allowing strengthening family ties and friendship bonds. Social reasons to travel to Ria de Aveiro are definitely more important to women and it is women who have been identified to be the ones who are more likely to have environmentally protective behaviors (Gonçalves & Guerra, 2008; Steel, 1996). The wealthiest visitors, compared with less wealthy ones, do not consider social reunion one of the main motivations to choose Ria de Aveiro for their trip.

Urban Tourism. The urban tourism in Aveiro region has an appreciable representation due to the proximity to Aveiro city (with around 75 000 inhabitants). Both activities and reasons related to urban tourism have a strong association to the foreign sub-sample of visitors, which is consistent with usual behaviors of foreign tourists tending to come and wanting to get to know the historical and cultural heritage of the main cities. Foreign people, or the ones mainly visiting the urban component of the region, did not reveal an emotional feeling with the Ria de Aveiro region since they might be doing the visit for their first time. Touristic reasons were not among the main reasons chosen to visit Ria de Aveiro lagoon, however touristic activities such as sightseeing and Ria de Aveiro cultural heritage were selected as main activities. This may indicate that people go to this site for a variety of reasons and purposes and they end up doing some touristic activities in the city anyway.

Fishing area. Coastal lagoons are highly appreciated habitats for recreational fishermen either to fish from shore or from a boat and Ria de Aveiro is no exception. A typical fisher in this lagoon was found to be male, aged above 50 years old and not very wealthy. Fishing activity was absent of the choices of the richest visitors. Overall, fishermen feel very attached to this lagoon perhaps because they may be locals with a special connection to their origin or visitors that gain a feeling of protection of the area where they catch their fish. The highlight of fishing activity suggests that visitors would value actions by managers to restrict motorized water activities to minimize damage and water pollution in order to preserve fish quantity and diversity. The regulation and control of fishing activity, including providing information about sensitive species, and the continuous monitoring of fish stock would allow the sustainability of this management plan. As previously seen, fishermen have an emotional connection with Ria de Aveiro region which may make them more prone to preserve the natural resources from which they directly benefit.

II.1.4.3 DIFFERENT AREAS, DIFFERENT PEOPLE AND DIFFERENT PURPOSES

The lagoon is mainly surrounded by four distinct municipalities that proved to attract different types of people that search specific qualities of the areas. The diverse targets as well as particular needs and demands in relation to the recreational site suggest that a differentiated management approach should be taken towards those areas.

The ***Aveiro*** municipality is almost entirely composed by one of the main Portuguese cities: Aveiro. In Aveiro municipality, people up to 50 years old (especially young people) and foreigners are overrepresented. The city is a highly touristic area with many historical and cultural attractions, and therefore the municipality is primarily sought for urban tourism-associated activities and reasons. The historical center is rather walkable thus many young people and adults (perhaps families), national and international visitors, travel here to get to know the place. Here, most tourists have interest solely in the urbanized area, which may be the reason they didn't manifest much of emotional connection to the lagoon habitat. However, the city is located in the lagoon's periphery, with a close physical connection to it, where certain visitors pass by on their trip to other areas around the Ria. However, the long distances and weak transport networks makes it hard for tourists, mainly non-native ones, to reach the other areas of the lagoon. Perhaps an improvement of public transportation around the coastal ecosystem would enhance visitor's opportunity of having a more naturalistic experience.

In ***Ílhavo***, visitors surveyed were mainly older Portuguese people, from adults to seniors. Visitors explicitly revealed preferences for fishing activities and, in fact, there are areas in this municipality where people gather to fish as it is the case of the shoreline near the tallest Portuguese lighthouse in Barra. Actually, Ílhavo is deeply connected with the sea and the fisheries and the main harbour of the region is located in this municipality. One of its main attractions is the Maritime Museum of Ílhavo, witnessing the strong relation between local people and the aquatic environment, with emblematic exhibitions allusive to cod fishing. Naturally, leisure- and nature-related reasons to visit stand out for this municipality. Various water sports facilities like marinas and nautical centers can be found in Ílhavo, enabling and motivating people to do water activities there. There are also several beaches in both sea and lagoon sides of the municipality.

People over the age of 36 years old are the majority that opt mainly to come to ***Murtosa*** municipality where the relaxation is considerably appreciated. The long lagoon beaches and calm environment makes it a great location to rest. Nature-related activities assume a high relevance in Murtosa probably as a consequence of 81% of the municipality being included in Ria de Aveiro's SPA (ZPE, 1999), which also includes the Natural Reserve of São Jacinto Dunes. This municipality has a vast area where a mosaic of habitats is present, such as saltmarshes, salines, mudflats and areas with reed, that represent important feeding and reproduction sites for many bird species. By the presence of multiple bicycle paths and cycling events and rentals, as well as numerous environmental education boards, this site tends to promote a consciousness about eco-friendly behaviors in its inhabitants and visitors.

Estarreja is a municipality where adults were regularly found and it's mostly known for BioRia. BioRia is a project of nature and biodiversity conservation that has increased the general awareness about Ria de Aveiro. It's characterized by a network of paths in direct contact with nature, equipped with display panels and supporting structures available to visitors. Nowadays, the paths' network covers a variety of habitats and it holds a strategically located Environmental Interpretation Center (CIA) with the aim of raising environmental awareness and allowing visitors to request a guided tour where they are able to get to see and learn about the biodiversity of the area. People surveyed in this municipality

proved to give preference to land-based nature activities as well as nature-related reasons that coincided with the importance of this type of initiatives in the municipality and, in general, in Ria de Aveiro region.

II.1.4.4 VISITORS ATTITUDES TOWARDS POSSIBLE CHANGES TO LOCATIONS

Visitors to this coastal lagoon had very distinct opinions and "don't know" responses about the evolution of environmental problems in Ria de Aveiro in the last two years. The Portuguese acknowledge having none or little information about the environmental issues that take place in the country (Almeida, 2004). Even so, one of the survey's question intended to evaluate visitor's response in relation to changes in access to good quality recreations areas. These changes are linked with changes to the ecological situation of Ria de Aveiro lagoon and people were asked to state the number of future visits they expected to make in each state of degradation or improvement. Prior to this question a small text was presented to explain to respondents some of the reasons that may change the access to some specific areas and that they are all associated with good or bad management and conservation of the site. The lagoon assessment might be restricted due to low water levels caused by the lack of dredging of the channels and inlets, restricting easy boat access through the estuary, or to the closure of approximately 50% of the ocean beach for 2 months annually for the protection of bird breeding sites. Otherwise, the access could be improved as a result of more dredging and intervention that keep the inlets open and of the construction of additional waterways for boating and boardwalks for easier access through the dunes. Visitors reacted significantly to the changes in Ria's ecological situation, increasing their expected number of visits in the following couple of years if access improves and decreasing the visitation frequency if the lagoon was to be degraded and access restricted. These results highlight the major importance to visitors of a well-managed coastal area.

In the opinion question where people had to face the relationship between a conserved and well-managed ecosystem with their recreational activities some interesting responses were given. Above all, visitors recognized the importance of good environmental health, achieved by good management, in the improvement on their recreational activities from fishing and other water-activities to camping and walking. By acknowledging this, recreational users demonstrate interest in the preservation of the natural resources of this coastal lagoon. They also agreed that additional water exchange through the inlets are essential to maintain and even improve environmental health revealing that they care about alterations on water flow merely for environmental concerns. These visitors may then be prone to relate to environmental issues and be sensitive to environmental awareness.

II.1.4.5 NATURE-CONCERN TOURISM OR PURE LEISURE

Coastal lagoons' visitors can experience a wide range of opportunities offered by the recreational site. However, some personal motivations and some activities people seek out may be more precisely associated with not just recreation but reflective of pro-environmental attitudes. As seen in the previous sections, the sociodemographic characteristics, as well as the municipality considered, are associated with a variety of preferences for recreational activities.

The analysis of the activities and visitor type indicate that there are different preference sets motivating visitors to travel into different municipalities within Ria de Aveiro. For example, nature-related reasons are less relevant in the more urbanized Aveiro municipality than for the other three less urbanized municipalities, mainly due to the different degree of recreational opportunities each municipality has to offer to visitors. The frequently cited nature-related motivations to travel to the coastal lagoon, such as the ones of being close to nature and to water, reflect a clear demand and desire for natural environments. People expect to satisfy their preference for experiencing nature involvement in their visits to these areas. The overrepresentation of nature-related choices highlights the prominent

relevance of the ecotourism sector, i.e. the responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education (TIES, 2015).

Activities related to "watch, study, identify, photograph, sample, observe, and learn about natural or cultural history" were grouped into so-called 'appreciative recreation activities', category conceptualized by Cordell (2004). Picnicking, Ria de Aveiro cultural heritage, bush walking, birdwatching, nature study and camping are therefore included in appreciative recreation. Other types of outdoor recreation include consumptive recreation (fishing and hunting) and mechanized activities (boating, motorbike and 4 wheel riding). Recreational activity preferences influence the attitudes towards the conservation of nature resources versus their development for recreation (Barker & Dawson, 2010). A stronger preservationist orientation is common for visitors undertaking appreciative recreation (Jackson, 1987; Tarrant & Green, 1999; Wolf-Watz et al., 2011). People adopting pro-environmental attitudes are more predisposed to strongly support fauna and flora conservation than those with fewer concerns about the environment (Bjerke et al., 2006; Bright & Porter, 2001; Jackson, 1987). Although people's attitude toward the environment does not have a straightforward effect on the increase of pro-environmental behavior, the preferences for appreciative recreation activities seems to act as a mediator between the attitudes and the behaviors, through the direct experience with the natural environment (Lee & Jan, 2015; Tarrant & Green, 1999). Undoubtedly, appreciative recreation activities outweighed the consumptive or mechanized activities carried out by Ria de Aveiro visitors (see Figure 14). Participation in these types of activities requires a direct contact and experience with the natural environment which not only may reveal a more conservationist philosophy towards nature but it may act like a predictor of responsible environment behaviors (Barker & Dawson, 2010; Bjerke et al:, 2006; Wolf-Watz et al., 2011). It is likely that these ecotourists play an important role in coastal lagoon tourism because their benefits are directly associated with the quality of the environmental condition. It is expected that they will continue to reveal an enhanced focus on environmental issues and will develop into a very good audience for environmental education (Chin et al, 2000).

Environmental managers could therefore consider promoting management that is consistent with an increase in appreciative and environmentally sensitive outdoor recreation activities, along with a decline in the preference for mechanized and consumptive activities (Jackson, 1987). Given a prevalence of this type of tourism, an investment in environmental education would be likely to induce ecosystem protection and conservation and evoke improved environment behaviors and respect for the regulations imposed by the managers that protect its ecological system (Spanou et al., 2012). There is also the added benefit that managers can learn from the responses of the visitors and therefore sites could benefit from taking note of their opinions and preferences. For example, visitors stated what they have done and cared about and some visitors explicitly asked for more facilities and information about the site. More informative facilities on site could fulfill this demand for more information and also provide more education that will in turn lead to more care and concern, as discussed above.

II.1.5 CONCLUSION

Coastal lagoons, such as in the case of Ria de Aveiro, are ecosystems that are both ecologically-sensitive and touristic-attractive. The increasing desire to get some relaxed time in a natural environment to rest from hectic daily life styles is boosting the expansion of nature-related tourism. In order to preserve the natural resources, realistic and sensitive management strategies for such areas are necessary. The main challenge is to find the balance between preservation and utilization of the available resources. This research is motivated by the position that a key to successful planning is some form of

visitors' involvement and acknowledging their needs and interests. Ideally, continuous monitoring to detect management effectiveness and changes is called for.

Considering this Portuguese lagoon, data on visitor's characteristics and preferences was lacking, which constrained management decisions. Relevant information collected through the survey includes the activities visitors mainly carry out in this recreational site as well as the main motives for their Ria de Aveiro trip. Preferences proved to be dependent and significantly different when considering visitors with different sociodemographic features. These results could enable coastal managers and tourism stakeholders to better perceive and understand the public target of each recreation opportunity. Municipalities also seem to have a major relevance in the activities undertaken. Thus, municipalities could consider different management plans and goals in ways that are sensitive to the sociodemographic characteristics of their visitors and their preferences. Acknowledging and understanding all these differences in the preferences and perceptions of visitors could be used to develop an integrated management strategy that considers both resource protection and visitor experience (Sayan & Karagüzel, 2010).

Ecotourists hold pro-environmental attitudes and thus they demonstrate preferences in participating in appreciative recreation activities. It is the direct experience with the natural environment that triggers behaviors towards environmental protection and conservation (Tarrant & Green, 1999). Sustainable tourism can only be accomplished when all the involved parts (environmental managers, stakeholders and tourists themselves) develop ecologically, economically and ethically responsible behaviors (Schmitz et al., 2007; Spanou et al., 2012). Activities related to these type of tourism should therefore be promoted over activities with a negative impact in ecological conditions of ecosystems. Thus, ecotourism can be considered a relevant contribution to environmental awareness and education and, furthermore, could support programs for the conservation of natural resources if the tourism revenues generated through this type of visitor were earmarked for conservation (Naidoo & Adamowicz, 2005).

Further recommendations include the need to carry out visitor surveys in the other natural areas which are also open to recreation and ecotourism, in order to better understand visitors and manage these areas. Another important and potentially useful study would focus on crossing data from recreational visitor behavior and the ecological changes of the area as a result of some management plan. This has already been done for other sites (Fearnley et al., 2012) and would give information about management effectiveness.

II.2 – ECONOMIC VALUATION

II.2.1 INTRODUCTION

II.2.1.1 Environmental Economics

Environmental economics is the sub-field of economics that deals with natural resources and environmental issues. The theoretical basis of environmental economics relies on the neoclassic theory of consumption that is based on the utilitarian theory and also on welfare economics. According to the utilitarian theory, each individual obtains utility or measurable satisfaction by consuming goods and services offered by the environment, and acts rationally to maximize that utility. Thus, ideally, society would allocate resources needed to produce those goods and services across all productive activities in such a way that the result is that aggregated individual utilities are maximized. Welfare economics is the study of how societies can undertake such an 'optimal' allocation of resources so as to improve social well-being (Tisdel, 2005).

The inclusion of economics in environmental issues is crucial because "no economic decision can be made that does not affect our natural and built environments. No environmental change can occur that does not have an economic impact". However, the impacts in the environment have not been well reflected in economic decisions. In other words, the value of environmental impacts is not incorporated in decisions that take place in markets because environmental goods and services are not directly tradable in markets for a market price (Balmford et al., 2008). For example, if a new factory is designed to be built within the wetland, there is no knowledge about the monetary cost to the environment in lost biodiversity, recreation sites or water treatment. Therefore, only the economic monetary benefits of the factory are taken into account whereas the costs of environmental benefits that may be lost are disregarded. Thus, environmental economics addresses this 'missing market' problem by estimating the monetary value of such environmental benefits so that an overall socially optimal decision can be achieved concerning the amount of activity (factory activity in this example) that includes environmental impacts as well. Environmental economists develop tools to estimate costs and benefits in monetary terms for analysis of resource allocation questions that have environmental impacts. This enables managers to estimate the monetary value of natural resources using economic measures in order to perform more inclusive, and then more effective, cost-benefit analysis of management projects and policies where there are both market and non-market goods and services (Laurila-Pant et al., 2015).

II.2.1.2 Cost-Benefit Analysis (CBA)

CBA is an established practice of supporting the analysis of policies, projects or programs that relies on the principles of welfare economics, widely used in management of natural areas. The objective of this analysis is to compare all the benefits and costs arising from a certain action, expressed in a common unit, in order to measure the net gain or loss to society. This requires the identification and evaluation of all the measurable benefits and costs and then comparing them, in order to determine whether the action provides net economic benefits (Bergstrom, 1990; Naidoo & Adamowicz, 2005). CBA can be applied to accept or reject a management plan accordingly to the prevalence of the benefits over the costs or otherwise, respectively. Furthermore, it can be used as a tool to compare and assess alternative management policies for the purpose of correctly select the one that maximizes net benefits and public acceptance (Laurila-Pant et al., 2015).

In cases where the policies under evaluation affect the social well-being, the CBA aims to inform decision-makers about the extent to which its implementation will affect the welfare of society. As far as nature conservation policies are concerned, the valuation of the costs is easier than the valuation of the benefits. There are real challenges in estimating the benefits of conservation, and one of the reasons for this relies on the fact that even specialists have incomplete information about all the benefits of conservation now and in the future for complex ecosystems. Many costs and benefits will never be measurable in monetary terms so that they can enter a CBA, however this is possible for some types of non-market environmental goods and services. For example, ecosystem services provided by wetland loss in water treatment can be estimated as the costs avoided by not having to build another or a larger water treatment plant because a wetland is performing this function. This is a monetary value that can be included in the environmental costs of a wetland in the case of the factory construction discussed above. Some other values are more difficult to estimate. For example, the benefits enjoyed by recreational users when they visit the wetland and do bird watching have no alternative in a market, as for the water treatment example. The fees paid to camp at the wetland are an extremely small share of the total benefits received by visitors. The large majority of the total benefit enjoyed is non-market, which led environmental economists to develop tools to estimate such non-market values. The economic valuation methods that assign a monetary value to natural resources that are not directly tradable in markets has been gaining in importance for use in CBA over the past many decades (Braden, 2000). The motivation to attach monetary units to non-market values is that the more benefits and costs we can directly include in CBA the more complete and convincing is the analysis. While accepting that estimates of the non-market values are not precise, may feel that it is far better to demonstrate that these values are significant and that they matter in decision-making about management options than to leave them out. Too often, just adding in a discussion of biophysical losses is ineffective in saving ecosystems when market values of farming, irrigation, urban development and high priced tourism developments can demonstrate profitability in monetary terms.

II.2.1.3 Economic Value

The concept of **economic value** consists in the monetary value expressed by individual consumer preferences (consumer behavior), which is based on the utilitarian and anthropocentric perspective of welfare economics. People reveal their preferences through the choices and tradeoffs they make, given certain constraints such as those of income or available time. Economic value is usually measured in monetary terms, which provide a common metric for comparisons between goods and services. The maximum amount of money that a person is willing to give up to obtain a good or service is commonly defined as the "**willingness to pay**" (WTP).

As the price of a good increases, people will generally purchase less of that good. In economics, the inverse relationship between the quantity demanded and the price of a good (assuming prices of other goods and consumer's incomes are constant) is referred as the law of demand of a product. This allows the estimation of the **demand function** for that good, from which we can obtain the demand curve (Figure 32). For a certain quantity of the good, the demand curve reveals the willingness to pay that can be considered as the maximum amount people are willing to pay. If an individual's WTP is lower than the market price, he or she will not purchase the good. If they are willing to pay more than the market price then their values exceed the market price (Piriyapada & Wang, 2016). The individual's excess of WTP beyond the market price, is defined as the **consumer surplus.** The total economic benefit from a good or service can be graphically shown to be the area below the demand curve for a good or service. The consumers pay P* for the amount they consume, giving the pale total expenditure box in Figure 32 and they do not pay for the consumer surplus. Hence we call the consumer surplus the

consumer's net benefit. Adding up the consumer surplus for all consumers in the market gives the total consumer surplus.

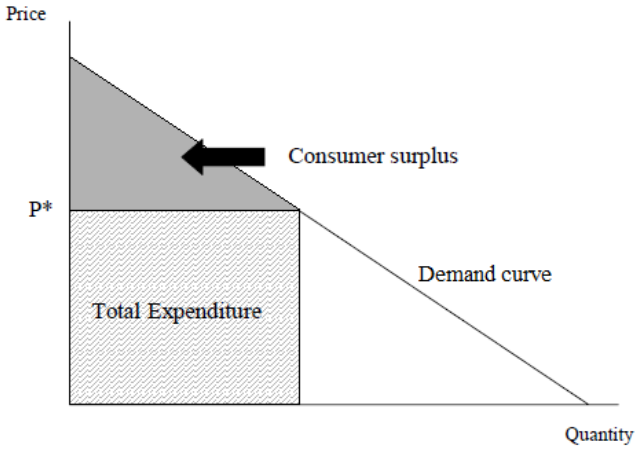

Figure 32: Relation between the demand curve and consumer surplus. Consumer surplus consists of the area below the demand curve and above the market price (P*). It is considered as the willingness-to-pay for a good beyond its total expenditure on that good. Source: Mayor et al. (2007).

Consumer surplus, as the net benefit or extra utility which people gain from consuming goods and services, can be calculated and compared across methods and also across locations and with market values. The consumer surplus thus provides a common concept for comparison and is the relevant concept for assessing the net value attached to the consumption of the good or service for CBA.

An outline of the components of the **total economic value** (TEV) of an ecosystem is provided in Figure 33. TEV applies to all goods and services but here we focus on the types of interest for ecosystems. Examples are included as well as the economic tools that have been developed to estimate the dollar value of the components of TEV when there are no markets that would reveal a price. TEV is a concept that encompasses the aggregation of all economic values representing the range of benefits of the ecosystem. The TEV can be split into use values (UV), defined by the benefits individuals obtain from physically using the resources, and non-use values (NUV), referred as the utilitarian values individuals attach to the resources without using them. UV can then be divided into direct use (DUV) and indirect use (IUV). Direct use values of the coastal wetlands include both its consumptive uses of physical resources such as fish, shellfish and timber, as well as non-consumptive uses of wetland "services" such as recreation, ecotourism, in-situ research and education. Indirect use values derive from supporting or protecting activities such as waste treatment, flood control, storm protection and so on (Wattage, 2011). Non-use values (NUV) are defined as the values attached to knowing that the resource is maintained and can be divided in two categories: existence value is the value derived from simply knowing that a feature from the ecosystems continues to exist and bequest value is the value attached to knowing a resource will be maintained for future generations. Apart from use and non-use values we can define option values (OUV) as the values assigned to the maintenance and preservation of the ecosystem, to ensure the possibility of coming to use it in the future, and refer to all use values (direct and indirect) that may be carried out. OUV includes future recreation options.

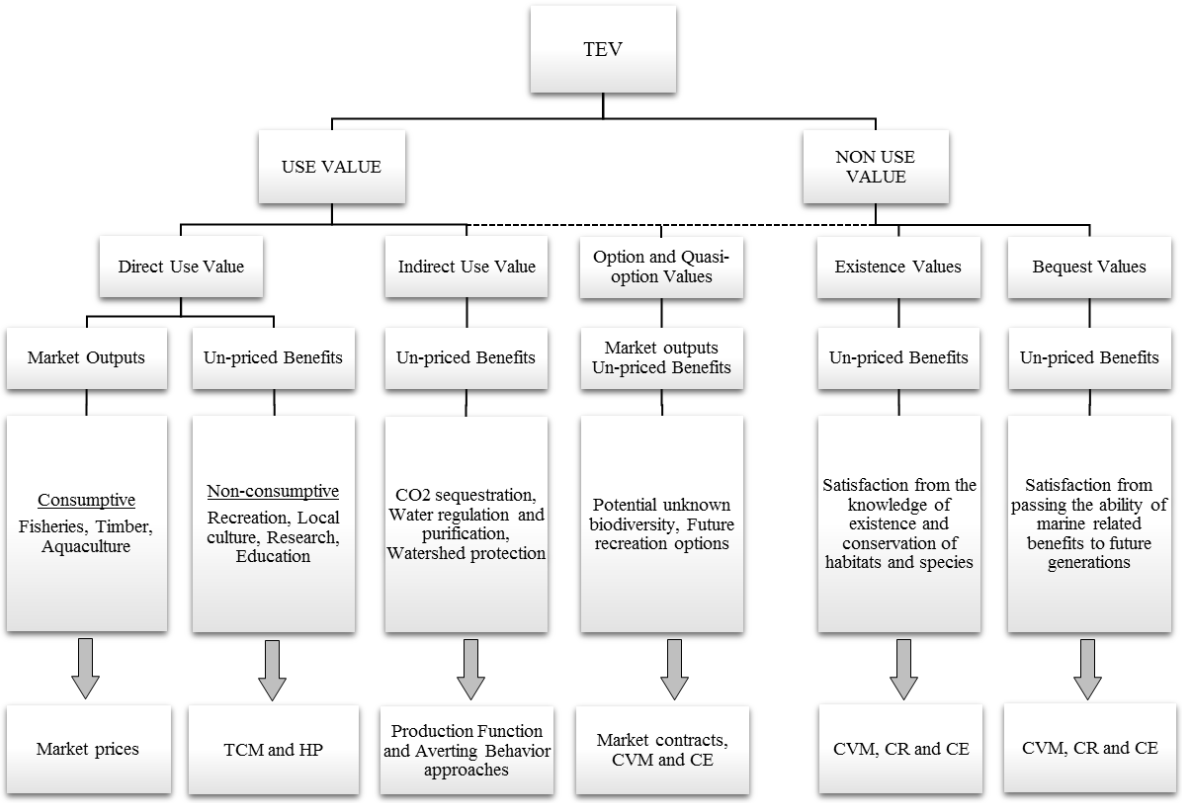

Figure 33: Components of Total Economic Value (TEV) of coastal and marine ecosystems with categories, examples and respective economic valuation methods. TCM – Travel Cost Method, HP – Hedonic Price, CVM – Contingent Valuation Method, CE – Choice Experiments, CR – Contingent Ranking. Adapted from Remoundou et al. (2009).

Wetlands produce a wide range of services making it expensive and time-consuming to conduct a valuation of the total economic value of the ecosystem (Camacho-Valdez et al., 2013). The current study, and in a context where the coastal areas are increasingly sought after by the provisioning of recreational experiences, the attention is focused on the use of direct non-consumptive value of coastal lagoons, specifically related to recreational services. Estimates of recreational use values will not cover the other additional types of value, thus recreational use values should only be considered as one component of the total of all values for this ecosystem.

II.2.1.4 Economic Valuation Techniques

Some coastal ecosystem services such as fish, shellfish and water (mainly provisioning) have significant economic value that can be estimated in monetary terms given that they are directly exchanged in markets at certain market prices (Wattage, 2011). Other services, such as wetland water purification, can be valued as the avoided cost of installing and running water treatment plants (infrastructure). There is, however, a range of other valuable goods and services provided by coastal ecosystems, mainly cultural and regulating ES, that are not valued in markets.

While many ES can be evaluated using a market value, most of the recreational experiences enjoyed by visitors is not paid for in markets through charges and fees. For example, camping, hiking, fishing and bird watching at wetlands can carry very low visitation costs while its enjoyment far exceeds the cost of the trip. These non-market values are as important as market values in assessing the benefits provided by wetlands and that should be included in cost-benefit analyses of management and policy options concerning conservation, remediation and development of wetlands. Economists have

developed environmental valuation techniques using non-market valuation approaches that can provide estimates of the value of a wetland (Jones-Walters & Mulder, 2009). While ES are typically assessed from the supply side, for instance the clean water supply costs avoided when wetlands clean the water, environmental valuation approaches assess values from the demand side. These approaches provide ways to estimate demand functions for these non-market ES, such as the value visitors assign to bird watching. Hence, the economic valuation approaches are used to obtain estimates of the monetary value of the willingness to pay (WTP) for aspects of ecosystems that are not provided through existing markets, which is the case for recreational use more generally. In this sense, the techniques are used to estimate the WTP for amounts of use of a wetland. This use is included in nonconsumptive (Figure 33) and it is also non-rival leaving the areas equally available to others to use. The WTP estimates enable us to calculate consumer surplus. In this sense, the CS can be thought of in our context as the non-market value associated with recreational use (Haab & McConnell, 2002).

II.2.1.5 Non-Market Valuation Methods

The economic valuation techniques of non-market values of ecosystem services have been widely used, since the mid-1990s, and each one of the techniques has its own advantages and disadvantages that need to be taken into account according to the objectives of the study (De Groot et al., 2010). The main distinction among the non-market economic valuation methods is based on the type of data collected, that is, whether they are observations of people's actual behavior at specific sites (revealed preference approaches) or from people's direct responses to hypothetical questions about their preferences regarding alternative options (stated preference approaches). Estimating the value of recreational activities using these two approaches can be accomplished in several different ways using methods that require somewhat different data as well as survey and analytical techniques (Figure 34).

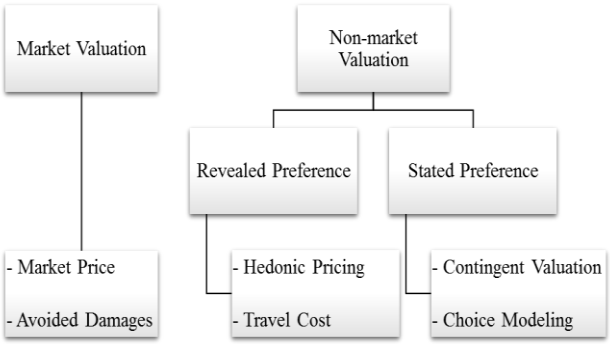

Figure 34: Economic valuation techniques of market and non-market goods.

The two most commonly used techniques for the estimation of non-market recreational value are the travel cost method and the contingent valuation method (Liu et al., 2010; Sagebiel et al., 2016). The **Travel Cost Method** (a revealed preference approach) makes use of the distance and effort involved in visiting a specific site to estimate the value that users place on the recreational activities. People reveal their preferences by actually visiting particular sites. Given their actual visitation, the monetary sacrifices they make to visit a site, such as travel costs, and together with the number of visits they make, can be used as the basic information for estimating the value they hold for their recreation visit and overall experience. This is based on the idea that people believe that the recreational visit to a specific site is worth the money and time they spend reaching there, and that the benefits they gain from the visit overcome the effort and sacrifices. The **Contingent Valuation Method** (a stated preference approach) involves asking people to state their willingness to pay for the recreational visit contingent on a hypothetical change in the cost of visiting. There are multiple ways of presenting this question in order

to assess how much people are willing to pay, which can then be assessed to estimate the value they place on the recreational visit.

The aim of this chapter is to outline how to apply the two most common non-market valuation methods for recreational use and then measure the willingness to pay for access to recreational goods and services at Ria de Aveiro, i.e. estimate the value visitors assign to their recreational activities in monetary terms (consumer surplus). Comparing both estimated models and ascertaining the implications of these values for conservation and management are also objectives of this chapter.

In the following sections both models will be detailed. Each model section will begin with a methodological introduction providing some statistical and econometric background (1. Theoretical framework), and then proceed with their application to the recreational visitation data collected in a section presenting the variables and specification of the models used (2. Data and Methods). Following this are the results and a brief discussion of the models estimated (3. Results and Discussion). After the section of each method (A. Travel Cost Method; B. Contingent Valuation Method), a general discussion (2.2) will include a comparison of the results of the two models, an estimate of the total value of recreation at the Ria de Aveiro based on the consumer surplus estimates, a comparison with results from the literature and some implications for conservation and management. Conclusion (2.3) will reflect on the results and the use of these economic valuation methods.

II.2.2 TRAVEL COST METHOD (TCM)

The concept of a TCM was first proposed by Hotelling (1949), as a potential tool to determine the value of non-market goods (Ortacesme et al., 2002). Valuation of numerous types of environmental goods and services have been undertaken using TCM, including outdoor recreational opportunities (Haab & McConnell, 2002; Heberling & Templeton, 2009; Lee et al., 2016). The main goal relies on the conversion of recreational visitors' physical and social benefits provided by the outdoor recreation experience into monetary terms (Ward & Beal, 2000). The basic idea behind this method of valuation of non-market goods, especially for recreational sites and recreational activities, is that the travel cost is the implicit price visitors pay for their trip to access sites to enjoy its services and amenities (Becker et al., 2005). The assumption behind this method relies on the fact that the recreational benefits at a particular site can be derived from the demand function estimated through the observation of visitors' behavior, which can be represented by the number of trips to that site and the inherent cost of a visit. The reasons for the success of this model are the fact that it is based on rational consumer's behavior, enabling accurate representation of consumer choices and preferences, and that uses real data from market transactions (Rolfe & Dyack, 2010).

The definition of the dependent variable requires the choice between the two variants of this technique (Ward & Beal, 2000). In the zonal travel cost method (ZTCM), the dependent variable is the number of visits made from a particular zone, over a specific period of time, divided by the population of that zone. In the individual travel cost method (ITCM), the dependent variable is simply the number of visits to a site made by each visitor over a specific period of time. For sites that have high individual frequency of visitation the application of the ITCM is more suitable (Rolfe & Dyack, 2011), which proved to be the case in Ria de Aveiro since it experiences a high individual visitation pattern (62% of respondents have visited the site more than 20 times).

The travel cost method conducted in this study, as for most of the TCM studies, makes use of behavioral data from "on-site" face-to-face surveys directly among recreational visitors. The choice of statistical technique for implementing the TCM is ruled by the characteristics of the survey and the data

collected during the survey. Some surveying and data considerations include the following. First, the dependent variable, which for the TCM is the number of visits to the site, only takes on values that are non-negative integers, making it a count variable. Second, the recreation data are characterized by being overdispersed, meaning that the variance exceeds the mean since a few visitors make a large number of trips while most visitors make only a few. Third, on-site sampling implies that all members of the sample have taken at least one trip to the recreation site, thus the value zero cannot occur in the data so it is truncated at zero. Fourth, the visitors who visit the recreation site frequently (or, in some cases, visitors who stay longer at the site) are more likely to be sampled than occasional visitors, leading to endogenous stratification.

Some statistical background concerning these characteristics of recreation data and how they guide model choice is presented in the following sections.

II.2.2.1 STATISTICAL FRAMEWORK

II.2.2.1.1 COUNT DATA MODELS

The non-negative integer form of the visit rate (the discrete dependent variable) makes it more appropriate to employ count data models for analysis (Bowker et al.; 2006; Shrestha et al., 2002), instead of standard regression techniques applied in earlier TCM analysis. Count data models' distribution is also characterized by higher concentration of lower discrete values (e.g. only one or two visits) and skewness to the left, which are both common features of individual travel behavior (Latinopoulos, 2014). The two main types of count data models commonly applied to recreation data are the Poisson and the Negative Binomial models.

Poisson

In the Poisson model, the probability distribution of a recreational user taking *y* trips to a specific site can be modelled as (Haab & McConnell, 2002; Loomis, 2003):

$$Prob\ (Y = y) = \frac{\lambda^y e^{-\lambda}}{y!}\ , y = 0,1,2, \ldots \qquad (2.1)$$

where λ is the intensity or rate parameter. This model can be extended to a regression framework by parameterizing the relation between the mean parameter λ and a set of independent variables *x*. An exponential mean parametrization is commonly used:

$$\lambda_i = e^{x_i'\beta} \qquad (2.2)$$

where *x* is the matrix of *k* independent variables and β is a matrix of coefficients to be estimated. In recreation demand models, λ is specified as a function of a set of explanatory variables (X) such as travel, site and respondent characteristics, including travel cost (TC).

An important property of the Poisson distribution is equi-dispersion, which is the assumption that the conditional mean is equal to the variance.

$$E(Y) = V(Y) = \lambda \qquad (2.3)$$

Empirically, the equality of the mean and variance in the Poisson distribution is not realistic in recreation demand modelling, since the variance often exceeds the mean resulting in an over-dispersion issue (Cameron & Trivedi, 1986). In order to accommodate this variance in the dependent variable, in cases where the overdispersion issue is present, the negative binomial distribution is widely used to model the data (Englin & Shonkwiler, 1995; Rodríguez, 2013).

Negative Binomial

The negative binomial model is a count data model that assumes a more general form than the Poisson model, accounting for data where the mean and variance are not necessarily equal by incorporating an error term (Greene, 2008; Haab & McConnell, 2002). These models are typically applied to handle overdispersion in recreational data, where there may be a wide range of costs associated with a single trip frequency (Greene, 2008; Latinopoulos, 2014; Martínez-Espiñeira & Amoako-Tuffour, 2008; Rolfe and Dyack, 2010; Shrestha et al., 2007). In these models, the parameter λ, instead of being just a deterministic function of the independent variables x as in the Poisson model, may be different from observation to observation where part of this difference is due to a random (unobserved) component. Thus, the negative binomial density distribution may be expressed as:

$$Prob\ (Y = y \mid x) = \frac{\Gamma(\alpha^{-1} + y)}{\Gamma(\alpha^{-1})y!}\left(\frac{\lambda}{\lambda + \alpha^{-1}}\right)^{y}\left(\frac{\alpha^{-1}}{\lambda + \alpha^{-1}}\right)^{\alpha^{-1}} , \alpha \geq 0, y = 0, 1, 2, \ldots \quad (2.4)$$

where $\Gamma()$ is the gamma distribution and α the dispersion parameter. Then, the mean and variance are expressed as:

$$E(Y) = \lambda = e^{x_i'\beta} \quad (2.5)$$

$$V(Y) = \lambda(1 + \alpha\,\lambda) = e^{x_i'\beta}(1 + \alpha_i e^{x_i'\beta}) \quad (2.6)$$

A likelihood-ratio test based on the parameter α can be conducted to test the hypothesis of no overdispersion. In the case where there is overdispersion, $\alpha \neq 0$ and thus the negative binomial model is more appropriate to be applied and also the interpretation of the coefficients is more accurate.

Truncation. For typical recreation data, where the dependent variable lacks the value of zero visits, the application of truncated models is of considerable importance. Failing to account for truncation leads to estimates that are biased and inconsistent because the conditional mean is mis-specified (Englin & Shonkwiler, 1995; Yen & Adamowicz, 1993). Examples of applications of this model include Shrestha et al. (2002) and Yen & Adamowicz (1993) who compare welfare measures obtained from truncated and untruncated regressions.

Endogenous Stratification. Finally, since the data have been obtained on-site, the sample may be not only truncated but also endogenously stratified. Several recreational studies have been using this correction for endogenous stratification (Englin & Shonkwiler, 1995; Martínez-Espiñeira & Amoako-Tuffour, 2008; Ovaskainen et al., 2012) although some authors believe that it may not be necessary (Englin et al, 2003; Shrestha et al., 2002).

II.2.2.1.2. CONSUMER SURPLUS (CS)

The CS in travel cost models is considered as the willingness-to-pay to access the coastal lagoon above and beyond current market expenses for the trip (Bergstrom, 1990). Thus, the CS represents the monetary measure of net economic value or net benefits of recreational use attached to that site, with site quality being kept constant at their current level. By assuming that the coefficient on TC is representative of cost tradeoffs, the CS per trip can be estimated as:

$$CS = -\frac{1}{\beta_{TC}} \quad (2.7)$$

where β_{TC} is the beta coefficient for the TC variable (Rolfe and Dyack, 2011). According to the law of demand (see introduction of current chapter) the coefficient for travel costs in a trip demand model is expected to be negative, which guarantees that the estimated means of CS per trip should always be positive.

II.2.2.2 DATA AND METHODS

The application of a TCM involves the specification of a number of assumptions for the analysis, which are detailed below.

II.2.2.2.1 VARIABLES

Dependent Variable

The dependent variable in these individual TCMs is the frequency of visits. In order to generate a higher variation in number of trips, a 2-year time period was chosen instead of the common one year[7]. In some collected surveys the question about the number of visits in the past 2 years (question 13) was not answered, however, this missing value could be estimated in the following way: in some cases people answered question 12, which had multiple response boxes with intervals for the total number of visits to the Ria de Aveiro, (for visualization, see Appendix 1) and since the variables are highly correlated ($r_s = 0.834$, $p < 0.001$), a linear regression between both allowed for estimating the missing values for number of visits for the last 2 years from the response for total visits, which could then be used as the dependent variable for the travel cost models.

Explanatory Variable - Travel Cost Variables

To perform a TCM it is imperative to gather travel cost data, however there is little consensus about the most accurate method of estimating travel costs (Rolfe & Prayaga, 2007). With the information collected in the survey, there are two common ways of estimating travel costs: use self-reported estimates by respondents (using responses of question 11) or estimate the costs, by the researcher, from reported distance travelled (responses of question 8) using a mileage estimate. Most studies use researcher-estimated costs for the travel cost variable (e.g. Fleming & Bowden, 2009; Fleming & Cook, 2008) but some use recreationist-reported (e.g. McKean et al., 2005). In this study both approaches were used to test for best fit.

To generate the self-reported estimates, recreational users were asked to identify their expenditure on: travelling costs (e.g. fuel); food; accommodation; and other (e.g. alcohol, boat costs, tour costs). The reported travel costs were then calculated by summing these categories but excluding food costs. Food costs are usually kept out of the variable because people would have this type of cost even if they had not made the trip. In order to include these costs, only the additional food consumption (compared to home) should be considered, which is hard for visitors to report and even for researchers to estimate.

For the alternative, researcher estimation of the travel costs is based on the type of transport with the distance travelled multiplied by a mileage rate utilized by Portuguese governmental institutions, as stated in the law 106/98 (DL 106/98, DGAJ). For small cars the value is 0.36€/km and for motorcycles is 0.14€/km. The value of 0.42€/km for big cars and 0.43€/km for four-wheel drives were calculated from the ratio of the same categories of cars used by the Australian Taxation Office (ATO, 2016). For those travelling by plane, an estimation was obtained from websites that search and compare flights (Momondo, 2016). A flight ticket from 1st of September (middle of the survey collection time period) was assumed from the city that respondents came from (if it has an airport) or from the capital city of their country to Lisbon (the capital city of Portugal and closest airport to the Ria de Aveiro) with addition of an estimated value (50€) for the transportation from Lisbon to Ria de Aveiro. If surveyed people did not report their distance travelled, then the estimate of distance was calculated from their city of origin

[7] Consumer surplus can be estimated per trip from count data models, which means that there is little difference in using 1- or 2- year trip rates as the dependent variable.

and/or zip code (Google Maps, 2016). Respondents were asked if their trip was part of a longer holiday in order to estimate only the travel costs associated with Ria de Aveiro's part of their trip. If visitors were on a multi-destination trip the distances used would be only for one way to the site, otherwise if they stated it was a single destination trip distances were doubled to count for the return trip home. Some studies include travel time[8] in the calculation of the estimated costs variable, however it was not included in the present study given that inclusion or exclusion of travel time generally has been found to not significantly influence value estimates (Ovaskainen et. al, 2012; Rolfe and Dyack, 2010).

II.2.2.2.2 MODEL SPECIFICATION

The basis of TCM is that outdoor recreational benefits at a specific site can be derived from a demand function relating the frequency of visit rate (dependent variable) to a number of explanatory variables (independent variables). The recreational demand for a single-site model is usually defined as a function relating the number of visits per period of time (Q13 [9]) to (Latinopoulos, 2014):

(a) the travel expenses (travel cost: Q11)

(b) the socio-economic characteristics of the site visitors (demographics: Q26 – Q30)

(c) the site characteristics (activities: Q14; visit reasons: Q16; attitudes: Q17; 18; 25; special features: Q21)

(d) other parameters related to the individual trips (group size: Q1; visit length: Q3; visit type: Q5; mode of travel: Q6; accessories: Q7).

Travel cost models were implemented in the STATA 10.0 statistical software. The explanatory variables were included through a forward and backward procedure according to their level of significance in each model ($p<0.1$). STATA software addresses multicollinearity problems. Both Poisson and negative binomial models were applied to estimate the recreation demand function. The negative binomial models tested were the simplest one, the one incorporating the correction for truncation and also the one assessing for endogenous stratification. Results from the tests of models' fitness to the data were considered to determine the most suitable model. For the models mentioned above, both travel cost variables (reported and estimated) were tested to appraise which had the best performance in the model. Results and discussion of the choice of the most suitable model follows below.

II.2.2.3 RESULTS AND DISCUSSION

A proportion of questionnaires were discarded due to non-response of the most crucial questions: 19 out of the 386 completed. The scatter plot shown in Figure 35 shows the expected inverse relationship between the number of visits and the travel costs, which is consistent with what would be expected in economic theory for a standard downward sloping demand curve. The number of visits tends to decrease as the cost per trip increases.

[8] Travel time is an opportunity cost because during the time taken to travel the visitors can do something else, for instance working, resting at home, visiting their relatives, etc. The bulk of literatures on TCM adopts the loss in hourly wages of the visitors as the opportunity cost for travel time.

[9] The Q letter stands for question, followed by its number in the survey (see Appendix 1).

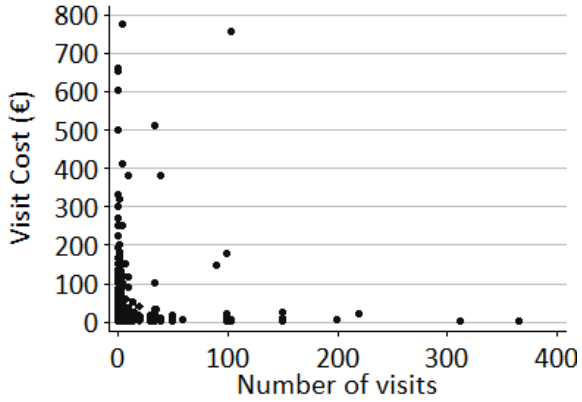

Figure 35: Frequency of trips and reported visit costs (€) for Ria de Aveiro (outlier observations were removed: Number of visits > 365 [3 obs.]; Visit Cost > 800€ [2 obs.]).

Four models were conducted for each travel cost variable, both reported and estimated (see models and statistical tests in Appendix 5), having all statistical significance (χ^2 statistic: $p<0.01$). The two travel cost variables had virtually identical results across the different specifications of the models and so the conclusions below are valid for both.

The negative binomial truncated at zero and with endogenous stratification would be expected to be the best model since it accommodates all the four challenging features of on-site sampling of recreational visitors as identified in the beginning of this chapter. Despite being conceptually the most appropriate model, differences in the models' fitness are a potentially valid criteria for selecting the most appropriate model to estimate the recreation demand function of this particular site. The Poisson model is, with no doubt, the model with the worst performance which corroborates the inadequacy of Poisson models grounded in the theoretical framework (nature if data) and with the validation of some goodness-of-fit statistical tests (Reported costs - Deviance Test: χ^2 [df] = 3577 [272]; $p<0.01$; Pearson Test: χ^2 [df] = 4421 [272]; $p<0.01$; Estimated Costs - Deviance Test: χ^2 [df] = 3371 [264]; $p<0.01$; Pearson Test: χ^2 [df] = 3995 [264]; $p<0.01$). Negative binomial models are then more suitable for this data as recognized by the fit measures and information criteria (also in Appendix 4). The correction for truncation improves the performance of the model demonstrated by a higher log likelihood value and lower values for Akaike (AIC) and Bayesian (BIC) Information Criteria (both measurements commonly used to evaluate the fitness of the models in comparison terms; for details see Appendix 4). Finally, the correction for the endogenous stratification has almost no impact on the model performance in these estimates (lower log likelihood value and higher AIC and BIC than the negative binomial model zero-truncated). Similarly, some studies have been reporting that the correction for endogenous stratification on top of zero-truncation does not make much difference in estimates (Englin et al, 2003; Martínez-Espiñeira & Amoako-Tuffour, 2008; Shrestha et al., 2002), being in conformity with these results (Appendix 4). In some cases, on-site sampling is not subject to endogenous stratification if the sampling strategy is carefully designed to avoid it (Martínez-Espiñeira & Hilbe, 2008). The models reported here are the ones that are both valid in theory and that have the best performance for this dataset, which are zero-truncated negative binomial models, both for reported and estimated travel costs.

Table 2: Travel Cost Method. Use of negative binomial models truncated at zero, using both estimated and reported travel cost variables.

	ZERO-TRUNCATED NEGATIVE BINOMIAL REPORTED COSTS		ZERO-TRUNCATED NEGATIVE BINOMIAL ESTIMATED COSTS	
	COEFFICIENT	STD ERROR	COEFFICIENT	STD ERROR
CONSTANT	1.0608***	0.2367	1.0894***	0.2476
TRAVEL COST	-0.0025***	0.0007	-0.0024***	0.0009
BEING FOREIGNER	-2.5090***	0.2653	-2.1219***	0.2853
NUMBER OF PEOPLE IN GROUP	-0.0309***	0.0085	-0.0332***	0.0086
NUMBER OF DAYS IN RIA	0.0033***	0.0010	0.0030***	0.0010
DAY TRIP FROM HOME	0.6798***	0.1630	0.7270***	0.1661
ACTIVITY				
PICNICKING	0.4927***	0.1486	0.3345**	0.1526
BUSHWALKING	0.2901**	0.1444	0.3828**	0.1484
NATURE STUDY	-0.6722***	0.1859	-0.7090***	0.1850
RIA DE AVEIRO CULTURAL HERITAGE	-0.4259**	0.1652	-0.4523***	0.1644
4 WHEEL DRIVING	1.3814***	0.5153	-	-
FISHING FROM BOAT	0.5666*	0.3147	0.8895***	0.3267
RELAXING	0.6380***	0.1505	0.6687***	0.1547
REASONS				
BEING CLOSE TO WATER	0.4724***	0.1492	0.5344***	0.1479
ENJOYING THIS PART OF THE NORTH COAST	-0.4728**	0.2123	-0.4931**	0.2122
BELIEVE RECREATION OPPORTUNITIES DECREASING	2.0974***	0.4679	1.7164***	0.4830
BELIEVE ENVIRONMENTAL PROBLEMS INCREASING	0.7341***	0.1995	0.6502***	0.1949
SPECIAL AREAS - WATER	0.6360***	0.1654	0.5939***	0.1674
RETIRED	-0.5470**	0.2339	-0.4269*	0.2368
INCOME	1.06e-05***	3.34e-06	8.59e-06***	3.25e-06
α (DISPERSION PARAMETER)	1.0616***	0.1497	1.0716***	0.1555
NUMBER OF OBSERVATIONS	292		283	
LOG LIKELIHOOD	-925		-901	
CHI-SQUARE STATISTIC (DF)	246 (19)		228 (18)	
MCFADDEN'S R^2	0.1175		0.1123	
CONSUMER SURPLUS PER GROUP PER TRIP (€)	398.22		418.97	
CI (90%[8]) FOR CONSUMER SURPLUS (€)	275.67 – 715.26		266.26 – 999.2	

Notes: ***, ** and * indicate significances at the 1%, 5% and 10% levels, respectively.
Std Error: Standard error
DF: Degrees of freedom

Table 2 shows zero-truncated negative binomial models (ZTNB) which are statistically significant using both reported and estimated (likelihood ratio χ^2 [df] = 246 [19], $p<0.01$; and χ^2 [df] = 228 [18], $p<0.01$, respectively) and show good explanatory power, i.e. the model fits the data well (McFadden's R^2 statistic= 0.1175 and 0.1123, respectively). The parameter estimates for α confirm that overdispersion is present and that application of the negative binomial model is the most appropriate (α is significantly different from 0 [reported costs: χ^2=2789, $p<0.01$; estimated costs: χ^2=2605; $p<0.01$], otherwise it would collapse to a Poisson model).

ZTNB models using either reported or estimated costs have similar results. There was only one variable (*Activity - 4 wheel driving*) that was not significant using estimated costs and so it was removed

from the model. Besides that, the goodness-of-fit tests have identical results (McFadden's R^2 statistic= 0.1175 [reported variable] and 0.1123 [estimated]), the coefficient values are similar and the signs are consistent between models. The model shows that the expected number of visits increases or decreases according to the coefficient mathematical sign of each variable, i.e. increases with positive coefficient values and decreases with negative values. Key model parameters (such as travel cost) are significant ($p<0.01$) and signed as expected, with the expected number of trips appropriately declining as travel costs increase, creating a negatively sloped curve (Blackwell, 2007; Creel & Loomis, 1990; Shrestha et al.,2002; Wang et al., 2010). In other words, a recreational visitor of Ria is expected to take fewer trips as travel cost becomes more expensive, keeping all other variables constant. Inclusion of other explanatory variables makes a major improvement to model fit, confirming that recreational values are associated with heterogeneity in preferences meaning that many variables beyond cost determine the visitation rate. The variables presented in the models and shown in Table 2 all significantly influence the number of trips to Ria de Aveiro at the 5% level, except one variable in the estimated negative binomial model (significant at the 10% level: *Retired*) and one variable in the reported negative binomial model (significant at the 10% level: *Fishing from boat*).

The coefficient for *being a foreigner* is negative and statistically significant ($p<0.01$) suggesting that foreign visitors are likely to take fewer trips to Ria de Aveiro probably due to travel constraints regarding time and opportunity to travel but also to higher travel costs. The higher the number of people in a visitor's travel group, the less likely that the group will visit more often, probably because of logistical inconvenience of arranging a visit (Blackwell, 2007) and costs incurred by adults when there are children included in the group. The number of days spent per recreational trip has a positive influence on the expected number of visits, meaning that the higher number of days spent on the trip, the higher expected number of visits. Regarding the trip type, those visitors who make a day trip from home are more likely to have a higher frequency of visits likely due to the ease of reaching the site.

Several activities preferred by visitors and main reasons for visiting this site influence the expected number of visits both positively and negatively. Some activities such as *picnicking*, *bushwalking*, *4 wheel driving*, *fishing from boat* and *relaxing* have a positive effect on the visitation rate. Not only were these some of the main activities identified by visitors but they also seem to play an important role on regular visitation, which makes intuitive sense for a destination based primarily on outdoor recreation. Yet there are activities that decrease the expected number of trips like *nature study* and *cultural heritage*, possibly associated with foreigners' one-time visits. Some reasons for visiting the Ria seem to also have some influence on the frequency of visits to this site. *Being close to water* has a positive sign, supporting the expected importance of the water resource in this site, substantiated also by the positive sign of the variable that identifies the *water recreation areas* as being special to the visitors. On the contrary, *enjoying this part of the North Coast* has a negative sign, which means that these people visit Ria de Aveiro less often, probably because were visiting it as part of a multi-destination trip around this area of Portugal.

Visitors who believe that recreation opportunities are decreasing and that environmental problems are increasing in the last few years are more likely to have a higher visitation rate. It could be speculated that there may be concern about the uncertainty of having the same conditions of the ecosystem for many more years which makes them want to enjoy and make recreational use of it while good conditions last.

Retired visitors of this sample are less likely to make many trips per annum than visitors that are not retired, when other factors are constant, possibly due to the difficulties of reaching the area but the analysis thus far cannot define the reasons more precisely. The influence of income on the frequency of visits despite having a small coefficient is significant and positive, meaning that higher level of income

transmits a sense of economic security, as it enhances the spending capacities of an individual, enabling the visitor to purchase recreational and nonrecreational goods more easily (Bell & Leeworthy, 1990; De & Devi, 2011).

The results of the models reported here (Table 2) were used to calculate the consumer surplus visitors derive from having access to the recreational site using equation 2.7. If the consumer surplus is estimated using uncorrected models, it will lead to biased estimation of the recreation demand function and therefore also the expected benefit (consumer surplus) per visit. The consumer surplus (CS; Table 2) per group visit is therefore estimated using the zero-truncated negative binomial model. Estimates of CS are 398€ for the reported travel costs variable and 419€ for the estimated costs, which are very similar given overlapping confidence intervals. In order to apportion across visit length and adult group size (Table 1), the median values of these two variables was used rather than the mean values. The median is more appropriate in this particular sample because the mean values of these variables are skewed upwards (Table 1), due to a reasonable amount of local people reporting around 365 days as annual visitation rates for the Ria and unusually large groups with 100 adults. Thus the resulting CS using the median values was estimated at 199€ and 209€ per group per day and 100€ and 105€ per adult per day, using reported travel costs and estimated travel costs respectively.

The confidence intervals (CI) of the estimated consumer surplus is calculated using the Krinsky & Robb (1986) simulation technique. Thus, using reported travel costs the CS per adult per day is 100€ (90% CI[10] between 69€ and 179€) and using estimated travel costs the CS per adult per day is 105€ (90% CI[8] between 67€ and 250€).

II.2.3 CONTINGENT VALUATION METHOD (CVM)

This survey also included a CVM question to provide an alternative approach for estimating the value visitors attach to the recreational experience. The contingent valuation method (CVM) first came into use in the early 1960's and it is at present the most frequently applied method in the valuation of environmental resources (Spash, 2000). It is referred to as a stated preference method, because it relies on people reporting how much they would be willing to pay for a good or a service by creating a hypothetical scenario. Hence they directly state their values rather than 'demonstrating' preferences as in the revealed preference TCM approach wherein people actually visit thus revealing their preferences. CVM questionnaires can be designed to elicit willingness to pay (WTP) to secure that service or willingness to accept (WTA) to abdicate from it (Bateman et al., 2002). Most CVM studies are designed to elicit WTP estimates. The WTP is the maximum amount an individual would be willing to pay to preserve or improve a good or service. The researcher can then estimate the monetary value of the asset by calculating the average WTP of respondents.

The fact that the CVM is based on what people state they would do, as opposed to observing their actual behavior, gives the major advantages as well as disadvantages to the model. Because it is survey-based and refers to a hypothetical situation, contingent valuation is likely to suffer from hypothetical bias, which is defined as "the potential error induced by not confronting the individual with an actual situation" (Schulze et al., 1981). Strategic bias arises when the respondent provides a biased answer in order to influence a particular outcome. For example, results will be biased downwards if visitors are asked their WTP but they suspect that a fee may follow once they give that information, they may under-

[10] 90% confidence intervals are used here in TCM, instead of the standard 95% CI, to be comparable to the 90% CI of the CVM estimates. In CVM the calculations of the 95% CI resulted in a negative value for the lower bound being conceptually odd. Hence, the 90% CI is used throughout this thesis for consistency.

report their true value in order to minimize the anticipated fee. Alternatively, if they are more concerned with making sure that authorities spend on the sites in order to protect them, they may overstate and therefore upward bias their responses so as to demonstrate a very high public value. Information bias may arise whenever respondents are forced to place dollar values on environmental goods and services with which they have little or no experience. In such cases, the amount and type of information presented to respondents may affect their answers and this could be present in some visitors if they have just arrived and never visited before. Non-response bias is a concern when sampling respondents, since individuals who do not respond may have, on average, different values than individuals who do respond (Whitehead et al., 1993)

As the questionnaire is the main instrument for using the method, formulating a good questionnaire is crucial. Many of the differences in the estimates using CVM in other studies are due to the way the willingness to pay questions are posed. There are four common elicitation methods, including: open-ended, payment card, dichotomous-choice and bidding game (Ahmed et al., 2007). The dichotomous choice format, used here, is one of the most common ways to ask contingent valuation questions, due mostly to its advantages for avoiding many of the biases affecting other value elicitation formats (Cameron & Quiggin, 1994).

II.2.3.1 STATISTICAL FRAMEWORK

The CVM consists of the presentation of hypothetical scenarios to respondents in a survey format, where the scenarios involve some tradeoff between the amount of a recreational amenity (or environmental good) and a monetary attribute (Rolfe & Dyack, 2010). For the analysis of dichotomous choice (referendum), CVM data from the survey were analyzed using a basic random utility model (Haab & McConnell, 2002). In a CVM, respondents are offered a dichotomous choice, either ‘yes’ or ‘no’, between paying a fixed amount more for their visit or not. It is assumed that in order to maximize utility, the standard assumption in economics, individuals choose options that offer more utility (*v*). The probability of a 'yes' response is given by the probability that the new situation has more utility for the individual than the old one (Bockstael et al., 1989). It follows that when the nominated bid in a CVM survey is less than maximum WTP, individuals will answer 'yes', and *vice versa*.

For simplicity’s sake, a single question was asked to all participants. The respondents were asked if they would have made the trip if it had cost 10 per cent more and the ‘yes’ answer reveals that the respondent is willing to pay at least an added 10 per cent of his travel costs to still benefit from the environmental service (recreational visit). The location of the question meant that they were already reminded of their travel expenses and budget constraints given previous questions and were focused on the current trip. The focus of the CVM experiment was on the individual response, rather than for the group travelling together, so the term ‘you’ was highlighted in the question to emphasize this. It is important to note that there is still a possibility that some respondents may have interpreted the task on behalf of their group, in which case the CVM values that are reported are over-estimates.

II.2.3.1.1 DISCRETE CHOICE MODELS

Logit Model

Conventional discrete dichotomous choice CV studies employ binary response models, such as probit or logit. In standard binary outcome models, the conditional probability of the response being ‘yes’ has the following form:

$$P(y_i = 1|x) = F(x_i\beta) \qquad (2.8)$$

Both probit and logit models tend to yield very similar results, so there is no real empirical difference. Logit has been traditionally used because it is computationally easier to fit so the models can converge better. Nevertheless, probit models have an underlying assumption that the unobserved error terms are normally distributed, while in the logit models the error terms take a logistic distribution. So logit models may be better for count data situations where there is no assurance of a Normal distribution (Loomis & McTernan, 2014). In a logit model, the functional form can be expressed as (Amemiya, 1985):

$$F(x\beta) = \frac{e^{(x\beta)}}{1 + e^{(x\beta)}} \qquad (2.9)$$

where x is the matrix of k independent variables and β is a matrix of coefficients to be estimated

II.2.3.1.2 CONSUMER SURPLUS

What we are seeking is an estimate of the value attached to the dichotomous choice, which is discussed above as what economists call 'welfare' measures. In the contingent valuation method the consumer surplus is derived to be equal to mean WTP for a good or service. The CS estimate is then calculated from the resulting models by estimating the mean of the estimated individuals' WTP function. For example, the mean WTP that can be calculated from the logit model can be given as (Loomis & Ekstrand, 1997):

$$Mean\ WTP = \frac{1}{\beta_1}\ln(1 + e^{\beta_0}) \qquad (2.10)$$

where β_1 is the coefficient on the bid value variable and β_0 is either the estimated constant (if no other independent variables are included) or the grand constant calculated as the sum of the estimated constant and the products of the coefficient of other independent variables multiplied by their respective means (Loomis et al., 2000).

II.2.3.2 DATA AND METHODS

II.2.3.2.1 VARIABLES

An independent variable, *bid value*, was estimated multiplying the travel costs (both reported and estimated) by 10%. Two independent variables were created and tested separately in order to reach the most suitable model. Through the travel costs variable it was possible to calculate a bid value variable with the reported travel cost variable and one with the estimated variable.

The dependent variable in all the logistic regressions used to estimate willingness to pay is a binary variable (*WTP*) indicating whether the individual was willing to pay the offered bid (1) or not (0). Note that for the response "Not sure", it was assigned zero to the variable *WTP*, as is usually done.

II.2.3.2.2 MODEL SPECIFICATION

The contingent valuation question served a similar purpose to the TCM questions, which is to estimate the WTP. For CVM, the type of functional form estimated relates the binary choice of the WTP questions to:

(a) the bid value (10% of travel cost variable)

(b) the socio-economic characteristics of the site visitors (demographics: Q26 – Q30)

(c) the site characteristics (activities: Q14; visit reasons: Q16; attitudes: Q17, 18, 25; special features: Q21)

(d) other parameters related to the individual trips (group size: Q1; visit length: Q3; visit type: Q5; mode of travel: Q6; accessories: Q7; past visit rates (Q13)

The same statistical software, STATA 10.0, was used and the explanatory variables were included also through a forward and backward procedure according to their level of significance in the model ($p<0.1$). For comparison purposes, both probit and logit models were conducted. In order to reach the most suitable model, these models were tested with the bid value calculated from the reported travel cost variable and also with the bid value calculated from the estimated travel cost variable.

II.2.3.3 RESULTS AND DISCUSSION

It was not possible to reach a suitable model here the bid variable was significant when testing both models (logit and probit) using the bid value calculated from the reported travel cost variable (see Appendix 5). For that reason, only the bid value calculated from the estimated travel cost variable was used to conduct the model for the contingent valuation method.

Concerning the comparison between the performance of logit and probit models, both showed statistical significance (logit: likelihood ratio χ^2 [df] = 47.5 [7], $p<0.01$; logit: likelihood ratio χ^2 [df] = 46.8 [7], $p<0.01$) and resulted in equal signs of the coefficients and very similar values for goodness-of-fit tests. However logit models performed slightly better (log likelihood= -211.49; McFadden's R^2= 0.1009) than probit models (log likelihood= -211.81; McFadden's R^2= 0.0995). According to the theory, logit models are also more appropriate to use for this type of data (see section of II.2.3.1 Statistical Framework) therefore only the logit model with the bid value calculated from the estimated travel cost variable is reported here (see probit model in Appendix 5).

Table 3: Contingent Valuation Method results using the estimated logit model of the binary variable WTP on the bid and the additional independent variables.

	LOGIT ESTIMATED COSTS	
	COEFFICIENT	**STD ERROR**
CONSTANT	0.7156***	0.2133
CVM BID VALUE	-0.0112*	0.0061
WALKING	-1.1888***	0.2906
BRINGING TENT	-0.7958*	0.4290
ACTIVITY		
BEIRA LITORAL CULTURAL HERITAGE	-1.3235***	0.4843
FISHING FROM SHORE	-0.9026***	0.3375
REASONS		
WATER ACTIVITIES	0.9818**	0.3893
BELIEVE RECREATIONAL OPPORTUNITIES INCREASING	0.7874***	0.2469
NUMBER OF OBSERVATIONS	365	
LOG LIKELIHOOD	-211	
CHI-SQUARE STATISTIC (DF)	47	
MCFADDEN'S R^2	0.1009	
CONSUMER SURPLUS PER INDIVIDUAL PER TRIP (€)	106.27	
CI (90%[8]) FOR CONSUMER SURPLUS (€)	51.46 – 427.18	

Notes: ***, ** and * indicate significances at the 1%, 5% and 10% levels, respectively.
Std Error: Standard error

The fitness of the logit model presented is adequate (McFadden's R^2 value > 0.1), and the variables, besides *bid value*, that are significant ($p<0.1$) explanators of choice are shown in Table 3. The *bid value* variable has a low significance level ($p<0.1$) and a negative sign implying that an increase in the bid value (10% of TC) reduces the likelihood that respondents are willing to make the trip despite that, which is logical and theoretically acceptable. Some independent variables also showed that they significantly influence the willingness to pay the amount established to visit this recreational site (all significant at the 5% level except for *bringing a tent*). The *walking* variable has a negative sign in the model estimated, meaning that people whose way of transport through the Ria de Aveiro was on foot, with all other variables constant, had lower willingness to visit with the increased price. *Bringing a tent* also seems to negatively influence people's willingness to still visit this site, suggesting that these people (walking and/or with a tent) are seeking a low cost trip, making them less likely to accept making the trip with higher costs. Activities such as *Beira Litoral cultural heritage* and *fishing from shore* both have a negative impact, however the reason of visiting being the practise of *water activities* has a positive impact. Another variable that is significantly increasing the willingness to visit despite the increased cost is if visitors *believe that recreation opportunities have been increasing*, which may be motivating people to spend more to keep benefiting from the recreational activities that the ecosystem provides.

The results of the logit model enables the calculation of the consumer surplus, through the calculation of the mean willingness to pay, using equation 2.10 (Loomis & Ekstrand, 1997). Confidence intervals (CI) around mean WTP were calculated using a simulation approach of Park et al. (1991) employing 5000 draws from the variance-covariance matrix. As the CVM question was focused on individual responses, the CS estimates are values per person per visit (rather than per group). The CS using the estimated travel costs is then estimated at 106€ per adult per visit, leading to 53€ per adult per day (90% CI between 51€ and 427€).

II.2.4 DISCUSSION

II.2.4.1 ECONOMETRIC MODELS FOR THE ECONOMIC VALUATIONS

There are numerous economic valuation methods to assess non-market values attached to a benefit derived from cultural ecosystem services such as the recreational use and, for each, a choice of the econometric model must be made.

Conceptually speaking, the negative binomial model truncated at zero and with endogenous stratification is expected to be more accurate to apply for travel cost methods once it accounts for all four features of on-site data sampling: count data variable, overdispersion, no zeros and higher probability of encountering frequent visitors (for details see Results and Discussion of TCM). The best fitted model, as reported here, was the zero-truncated negative binomial with no correction for the endogenous stratification, which implies that this last correction does not improve the models by much. Thus, it was found to be necessary to take into account the overdispersion of the count variable with no zeros but the endogenous stratification correction is not crucial (Englin et al, 2003; Martínez-Espiñeira & Amoako-Tuffour, 2008; Ovaskainen et al., 2001). The results obtained with this revealed preference approach did not encounter any major difference between the estimates and coefficients using either reported or estimated travel cost variable (details in Results and Discussion of TCM). Key independent variables such as the travel cost variable had a significant effect and was signed as expected in all models. For the travel cost variable, the negative sign was in concordance with the standard downward sloping demand function for the goods and services in general consistent with the law of demand.

Regarding the contingent valuation method, the appropriate econometric model depends on the elicitation method used. For binary data, binary response models are appropriate. Between probit and logit there is no rule for choosing one over the other but the model with higher goodness-of-fit was the logit one, where the random term take a logistic distribution (see details in Results and Discussion of CVM). Only in the models using the bid value calculated from the estimated, as opposed to reported, travel costs were statistically significant. Also the key explanatory variable, the bid value, showed a negative signed coefficient that is logical and theoretically expected.

II.2.4.2 COMPARISON BETWEEN TCM AND CVM

The consumer surplus from the travel cost method can be compared with the willingness-to-pay value from the contingent valuation method, despite the differences in modelling and statistical assumptions (Carson et al., 1996; Ferrini et al., 2014; Mayor et al., 2007). Hence, it is expected that the estimates of recreational values using each model to be similar, but not exactly the same. In this study, the methods applied resulted in CVM estimates lower than TCM ones. Other studies have found the same outcome (Brander et al., 2006; Carson et al., 1996; Shrestha & Loomis, 2003). Systematic downward variation in CVM estimates compared to TCM estimates can be explained by a combination of factors, with the most common ones listed below (Haab & McConnell, 2002).

1) Multi-destination trips. Visitors to these sites are occasionally on trips that include not only this coastal lagoon but also other places. In this sample around 29% of the respondents were in this situation. This means that their travel estimates may be inflated because some additional travel costs may have been included. Hence, estimated TCM values may be larger because of this while the CVM estimates may not include such an inflating factor.

2) Different decision points. For the TCM estimation, visitors are asked about their costs of traveling to that site. The costs that have been incurred *ex post* are costs that were based on decisions visitors made before the trip. However, the CVM question is asked while visitors are on the trip and refers to their willingness to pay once they are on site. Since respondents have already made the trip and are at the site, their willingness to pay can be possibly changed by the better awareness of trip costs and benefits actually being experienced while at the site, the partial consumption of the recreation experience and additional budget constraints. In this sense, if the visit provided lower benefits than anticipated, it would not be surprising to find that TCM value estimate is higher than a CVM derived from on-site responses that would reflect the reality of the benefits in the WTP with CVM but not the WTP with the TCM. Hence, a lower CVM could be the result of poorer site conditions (ecological, accessibility, and others) than anticipated. In fact, some visitors have complained specifically about some drainage issues in Ria de Aveiro.

3) Existence of substitute and alternative sites. If the respondents are aware of the existence of sites that provide identical recreational opportunities, their willingness to pay increased costs for visiting that specific site (asked in the CVM question) may be lower. There was some evidence from Ria de Aveiro that respondents would have travelled to substitute locations if some special areas were closed, as 44% said that they would have chosen another area on the Ria de Aveiro, and 20% saying that they would have chosen a similar location on the coast.

4) Strategic behavior. If respondents were concerned about future entry charges or other taxes being imposed on them if they expressed a high willingness to pay this would tend to induce more conservative responses, i.e., they would have an incentive to under-report their true willingness to pay to avoid any suspected charge and therefore a downward bias on CVM responses would be expected. With TCM based on observed behavior of the respondents and actual market prices associated with visiting costs, no such biases exist. This hypothesis was tested by Rolfe & Dyack (2010). They showed

that repeat visitors, who are more likely to have greater concerns about future entry charges, showed significantly lower values with the CVM compared to the TCM as compared to once-only visitors who would not be expected to have such concerns.

5) Treatment of 'unsure' responses. Some visitors responded that they didn't know if they would have gone to the lagoon if the trip cost was 10% higher. These indecisive responses were treated as 'no' responses, a commonly-used methodology described in the literature. However, if these responses did not truly mean 'no', then this would contribute to a downward bias on the CVM estimate. From the people who answer the CVM question, a considerable amount of 21% responded that they didn't know for sure.

These reasons highlight that there are several potential reasons for such differences between estimated values obtained from the two techniques, specially inducing downward bias in the CVM estimates. Moreover, the analysis shows that the CVM model employed does not produce such a trustworthy estimate of WTP, since the bid value variable calculated with the reported travel costs was not significant (see Appendix 5) and even the bid value variable calculated with the estimated travel costs was significant only at the 10% level. Hence, the TCM results of this valuation are taken here to be the most reliable of the two non-market valuation methods.

II.2.4.3 AGGREGATE ECONOMIC VALUE

Given the CS estimates per visit from our visitor sample and the estimated total visitation to the site, it is possible to estimate the total annual recreational value. This value would represent the estimated total social welfare of visitation of Ria de Aveiro per one year by recreational visitors. Annual values for the CVM estimates are provided as well (**Error! Reference source not found.**), however, since the TCM estimates are considered to be more reliable, those are concentrated on here. Both consumer surplus values using reported and estimated travel cost variables came out with very similar results (reported TC = 100€/adult/day and estimated TC = 105€/adult/day), so the next paragraph concerns the values from the reported costs as an example, but calculations were made for both variables showed in **Error! Reference source not found.** as well.

Ideally, the number of annual visitors of Ria de Aveiro should be used to measure the total consumer surplus, however this value is not available from the local authorities. Therefore, using best available visitation estimates, both an upwards estimation and a more conservative one were made in order to reach a range of values for the total CS for Ria de Aveiro. Considering the whole region of Aveiro, with an annual estimation of 264 348 tourist visitors (INE, 2014), the economic value of recreational use of the region could be estimated to be approximately 26.4 million euros, with 90% confidence interval between 18.2 and 47.3 million euros (Table 4**Error! Reference source not found.**). This should be considered as a maximum value, given that it is likely that only a portion of those visitors go to the lagoon. The lower bound of the range was calculated using official numbers of visits reported for only two small areas of Ria de Aveiro (a network of footpaths and bicycle paths in Estarreja and the Natural Reserve of São Jacinto Dunes) collected from two entities, the BioRia (BioRia, 2015) and ICNF (ICNF, 2015). The sum of the values for both areas was used as a minimum annual number of 39 221 visitors[11] resulting in the minimum value of 3.9 million euros (with 90% confidence interval between 2.7 and 7 million euros) for the total welfare estimation (Table 4**Error! Reference source not found.**). The annual economic value of the recreational use in Ria de Aveiro was then estimated to be approximately between 4 and 27 million euros.

[11] The estimated value was calculated by summing the estimated 33 000 visitors from BioRia (BioRia, 2015) and 6 221 visitors from the Natural Reserve of São Jacinto Dunes (ICNF, 2015).

Table 4: Summary of Recreation Value Estimates with the calculation of the total consumer surplus per annum (€).

	TCM		CVM
	Reported	Estimated	Estimated
CS /group/visit (CI 90%)	398 (276 – 715)	419 (266 – 999)	-
CS /adult/visit (CI 90%)	199 (138 – 358)	209 (133 – 500)	106 (51 – 427)
CS /adult/day (CI 90%)	100 (69 – 179)	105 (67 – 250)	53 (26 – 214)
Annual number of visitors (no.)	39 221 – 264 348		
CS total (annual)	3.9 m – 26.4 m	4.1 m – 27.8 m	2.1 m – 14 m

m: million

The question then is, how does this value compare to other values of use in the area? Aveiro's harbour is one of Portugal's busiest fishing ports and, in 2010, generated an estimated 15 million euros[12] from approximately 10 000 tons of fish unloaded (LAGOONS, 2012). The annual estimation of fishing economic value is considered the gross sales revenue. Some portion of the 15 million euros is expected to be profit, which is the comparable figure with consumer surplus, but certainly not all. With consumer surplus in recreation estimated at between 4 and 27 million euros, using TCM estimates the economic value of the outdoor recreation services of coastal lagoons may be as substantial as the net economic value (profit) of the fishing activities and may even exceed it. Thus, these cultural ecosystem services clearly have non-trivial value and should be recognized as an important consideration for wetlands policies and management. The CS results are large enough, therefore, to potentially lead to justifying the allocation of resources into preservation of the ecosystems that provide them.

II.2.4.4 VALUATION ESTIMATES IN CONTEXT

In the literature, there is a wide range of estimates of consumer surplus for several natural parks (e.g. Beal, 1995; Carr & Mendelsohn, 2003; Rolfe & Dyack, 2010). In this study the survey and analysis were as similar as possible with Rolfe & Dyack (2010) and similar results were found. In order to put it in context, the appropriate exchange rates and price indexes were used to adjust Rolf & Dyack (2010) values to 2015 Euros in purchase power terms[13]. The TCM used for Rolfe & Dyack Australian lagoon study resulted in an estimation of 132€ (versus 105€ at Ria) and the CVM an estimated value of 103€ (versus 53€ at Ria), all per adult per day. The TCM result for the Australian lagoon is quite similar to the one for the Portuguese one, although the CVM estimation was rather different, even so it is included within the range of the confidence intervals calculated for Ria de Aveiro[14].

[12] The monetary value stated in the LAGOONS report for the fishing activity in 2010 was 14 936 957 € (LAGOONS, 2012).

[13] For comparison purposes the economic values originally expressed in Australian Dollars for the 2006 Coorong study were converted to Euros (2015) by first converting 2006 AUD to 2015 AUD using the Australian CPI deflator, and then the Reserve Bank of Australia exchange rate of AUD to Euros for 29 August 2015, which is the survey midpoint at the Ria de Aveiro (exchange ratio of 1AUS$ = 0.7096 €).

[14] Although the survey and questionnaire at Ria de Aveiro were very similar to the Coorong study, the CVM question was not the same.

Additionally, it is interesting to note that a recent study in the Seychelles (Mwebaze & MacLeod, 2013) used TCM to obtain the estimate of 128€ per trip for single-site visitors for the recreational use of marine parks, also similar to values reported here (within the confidence intervals). Estimates of the recreation cave diving in Florida revealed a value of approximately 155$ per person per trip, through TCM (Morgan & Huth, 2011). Using a CVM approach, Myers et al. (2010) estimated the recreational use value of household trips to view shorebird migration on the Delaware Bay (USA) of about $66–$90/household for a day trip (Ria de Aveiro estimate of 53€/person/day). The monetary value is from 2008 season and the average household size is 1.66. The benefits associated with recreational use of the Baltic Sea was also assessed trough TCM and Czajkowski et al., 2015 estimated the average of 85€/trip from the 9 countries along its coastline. They also revealed that an improvement of the water quality would increase benefits from 7 to 8% of the current annual benefits across countries. What is important is that despite the differences in approach, survey design, estimation and location, the estimates of values across sites have similar and non-trivial results for these marine sites that have been studied.

II.2.5 CONCLUSION

Ria de Aveiro is a Portuguese lagoon that is considered highly valuable in ecological and recreational terms. As for many coastal areas, cultural ecosystems services that make these areas particularly attractive for recreation and tourism. However, the value visitors assign to their recreational experience, representing social benefits that people derive from this site, had not been estimated yet. In general terms little is known about non-market values in coastal lagoons (Milcu et al., 2013). Although much has been discussed about cultural services of ecosystems (e.g. Daniel et al., 2012; Milcu et al., 2013), it is still rather difficult to derive estimates of the value of these services in specific systems such as Ria de Aveiro. The purpose of this economic analysis was to provide empirical analysis of the recreational value. With this research the recreational annual value has been estimated to be between 4 and 27 million euros for the Ria de Aveiro (TCM estimates). This represents a measure of the social welfare value that is related to the actual ecological condition through the values of recreational visitors. These results imply that recreational experience provided by the Ria de Aveiro make an important contribution to the well-being of coastal communities and overall visitors every year.

This economic approach of estimating the non-market value of ecosystem services provided to recreational visitors demonstrated that non-market recreational use values can be estimated with statistical significance using non-market valuation techniques, specifically travel cost method and contingent valuation method. The valuation of ES in monetary terms, means that given that there are monetary values, it can be included in cost-benefit analysis for management purposes and policy options. For example, if a management change that reduces recreational values is proposed, this reduction can be estimated and included in the CBA analysis of net benefits of options. These types of values are not commonly estimated for inclusion in management decisions and therefore the associated benefits are at risk of being disregarded (Daniel et al., 2012). If benefits are not included in cost-benefit analyses of options then those that may have met the criteria to be considered best, if full accounting of benefits were included for, such as conservation and remediation, for example, may be overlooked as too expensive when only their costs are fully included and not their benefits. Several studies have shown that ecosystems under conservation policies generally provide economic advantages that, in most cases, are equal to or greater than the cost of conservation (see details in Cimon-Morin et al., 2013).

One critical aspect of these analyses is knowing the number of visitors to the lagoon, which is required for calculating the annual value of consumer surplus (CS). In the future, it would be ideal to obtain a good estimation of visitation since it is frequently indicated as the single most important

indicator of cultural ecosystem services (Maes et al., 2016). The study considers recreational services (a direct use value) only. The value of other ecosystem services can be as great as that of recreational services (Endo et al., 2012). Thus an ideal study would encompass the whole estimation of the ecosystems' total economic value (TEV). To do this it is necessary to value both use value (direct use, indirect use and option values) and non-use values (existence and bequest values) of the ecosystem.

III – GENERAL DISCUSSION

III.1 GENERAL CONSIDERATIONS

This thesis allowed the application of powerful economic and sociological tools for combining knowledge on social sciences with natural sciences. The collaboration with national and international scientists specialized in study areas from ecology, to sociology and economics enriched it significantly.

Results from both Visitor Profiles and Economic Valuations of the recreational use of the Ria de Aveiro turned out to be relevant in achieving the goal proposed to combine sociological and economic perspectives to assess the importance of recreational benefits derived from cultural ecosystem services, so as to assist in the management strategies of a Portuguese coastal lagoon, Ria de Aveiro. The importance of this study also relied on the provision of information about visitors and visitation patterns of Ria de Aveiro, which was previously nonexistent but needed as the case of other ecosystems with ecological and recreational importance. Furthermore, this was the first economic valuation of recreation in Portuguese coastal lagoons.

The sociological approach considered for the analysis of recreational visitors indicated that the visitor profile, namely sociodemographic characteristics such as gender, age group, retirement status, nationality and income, could influence recreational behavior in this coastal lagoon. This provides clarification to the first scientific question stated in Section I.2. Some characteristics seemed determinant in the activities and reasons for visiting which people chose as the main ones for this recreational site. These characteristics and recreational behavior were also revealed to be dependent on the visitation of different municipalities. Overall, the bulk of reasons and activities undertaken at Ria de Aveiro was nature-concerned, highlighting the importance of this natural area as a recreational site. It is known that visitors that mostly undertake appreciative activities tend to have pro-environmental attitudes and behaviors and thus it could provide an opportunity to invest in environmental awareness and education of these recreational users. The economic analysis included in this thesis allowed the monetary valuation of recreation based on cultural services for this Portuguese coastal wetland, as a response to the second scientific question. Two econometric models using two valuation techniques provided estimates for the recreational use value of Ria de Aveiro. The monetary estimate for the social benefits represents a common currency for various stakeholders. Models obtained also acknowledged the influence of variables such as parameters related to individual trips as well as socioeconomic and site characteristics on people's preferences and the value of the recreational experience.

Results from both chapters of this thesis provide useful multidisciplinary information to form a basis of an integrated management framework, demonstrating the applicability in planning and management decisions questioned in Section I.2. The argument for protecting nature for nature's sake only works for the converted people (Admiraal et al., 2016) and therefore there is a need to take nature preservation to the next level. Improved sociological knowledge about visitors will likely contribute to a deeper understanding of the preferences, needs and demands for coastal lagoon recreational participation, providing a more informed basis for policy-making, planning and management. Moreover, an examination of the relationship between the preference for appreciative activities and pro-environmental attitudes may also contribute to long-term sustainable management plans. Valuation of ecosystem-based recreation allows the translation of ecological importance into a representative monetary value, which has already provided supporting arguments for the systems' preservation and biodiversity conservation (Martin-Collado et al., 2014; Mendes & Proença, 2011; Rogers et al., 2013).

Detailed implications of these results for conservation and management of natural areas is provided in the next section.

III.2 IMPLICATIONS FOR CONSERVATION AND MANAGEMENT

In the last couple of years the pressure on ecosystems' management strategies has been increasing (SCBD, 2014). Managers are requested to take into consideration the full benefit derived from natural services, as well as keeping systems healthy and sustainable and maintaining the structure of ecosystems by preserving biodiversity and habitats (Pascual et al., 2016). Historically, the way ecosystems have been affected by both policy decisions and stakeholder actions, has been degrading the supply of goods and services (MA, 2005). Wells et al. (1992) stated that people need to have an incentive in order to conserve natural resources. Decision makers, such as government officials, business managers, or local landowners, are the main actors considering the continued provision of ecosystem services although for most services there is little incentive for doing so (Tallis & Polasky, 2009). To counter the trend, the policy initiatives for marine and coastal ecosystems conservation have been expanding at international, European and national levels. Global initiatives such as the Millennium Ecosystem Assessment (2005) and The Economics of Ecosystems and Biodiversity (2010) aim to assess the conditions and trends in the world's ecosystems and the services they provide, as well as to improve the scientific basis for action to use them sustainably through decision-making at all levels. Having robust and reliable estimates is exactly what is needed to account for the values people assign to ecosystems and counter any politically biased decisions. The Portuguese context is suitable for the development of new methodologies that could help the sustainable management of marine and coastal ecosystems. Portugal was a pioneer in presenting, in 2006, a National Strategy for the Sustainable Development of the Ocean (EMAM, 2006) and is now committed to the EU biodiversity strategy 2020, which requires EU members states to "map and assess the state of ecosystems and their services in their national territory by 2014, assess the economic value of such services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020" (EC, 2011) (Maes et al., 2016; Schägner et al., 2016).

The use of Ecosystem Services Valuation (ESV) is broad and is becoming widely accepted and applied among decision-makers (Marre et al., 2016, TEEB, 2010). Laurans et al. (2013) reviewed the use of ESV to better support management synthesizing into three categories: *decisive*, *technical* or *informative*. *Decisive* use of ESV include the cases where economic valuation aims to previously inform a specific decision. Thus, when incorporated into a cost-benefit analysis (CBA) it provides relevant information of ecosystem services in terms of economic consequences to be assessed. Decisive use of ESV can be sub-categorized in: (a) *ESV for trade-offs*, by attributing a monetary value for ES that incorporates CBA process which will evaluate trade-offs between alternative management options enabling an optimization of social well-being; (b) *Participative ESV*, an approach that considers the monetary valuation as a 'negotiation language' that is a basis for discussions and negotiations of projects during management decision-making processes (instead of directly accounting for monetary comparisons to achieve a choice reflecting a socially optimal decision); (c) *ESV as a criterion for environmental management*, differs from the 'trade-off' category because this concerns only a specific organization and serves as a tool to prioritizing conservation efforts by providing information of options that would maximize benefits.

Technical use of ESV is applied after the decision of the policy or project and designs financial instruments (such as subsidies, taxes or fees) to implement that choice. Two sub-categories include: (a) *ESV for establishing levels of damage compensation*, applied in the cases where someone damages the

ecosystem services and are there obliged to pay a compensation price for the degradation, which can be in a form of compensating the anticipated consequences of an action or remediating the damages already caused by the action; (b) *ESV for price-setting*, includes the Payments for Ecosystem Services (PES) approach. This strategy can be used in two different ways: payments can be made by beneficiaries of services in which the amount payable can be determined by the WTP logic; or payments are offered to landowners that produce, protect or restore ES allowing these services to be available for people. A strategy combining both ways is also possible offering payments from beneficiaries to landowners.

Finally, *informative* use of ESV provides information indirectly influencing decision-making in general. Three types of this category are considered: (a) *ESV for awareness-raising*, it may be seen as an important means of guaranteeing that considerations on ES are accounted for in public and private choices. It provides a tool to reveal the economic value of social benefits that reinforces the insufficient biological argument for pro-conservation decisions; (b) *ESV for justification and support*, showing either economic justification for conservation plans or the economic relevance for conservation of decisions already taken; (c) *ESV for producing 'accounting indicators'*, allows decision-makers, or the public's opinion, to remain informed of the state of the natural capital and to integrate this information into their decisions in general. It ambitiously aims to construct natural heritage accounts.

Examples of all these uses of valuation approach of ES are reported in Laurans et al. (2013), however an example of CBA (Cost-Benefit Analysis) and another for PES (Payments for Ecosystem Services) for conservation goals are provided in the following studies. In tropical coastal ecosystems, mangroves have been suffering from land use conversion to shrimp aquaculture. By clearing the mangroves people receive a high market prices for the shrimp they produce, however they don't take into account the full costs associated with the loss of ecosystem services provided previously such as loss of habitat for coastal fisheries, loss of protection from storms, the loss of pollution filtration. A research study revealed that the benefits for society for conserving mangroves are greater than its conversion to shrimp aquaculture (Sathirathai & Barbier, 2001). The other example is in Central and South America and the project aims to encourage the adoption of silvopastoral practices by land users because it is thought to provide valuable local and global environmental benefits, including biodiversity conservation (Pagiola et al., 2004). This project has now created a mechanism that pays land users for the global environmental services they are generating. In general, some policies are being applied that provide incentives for the conservation and thus continuing provision of a wider set of ecosystem services.

III.3 FINAL REMARKS

Ecosystems are becoming degraded worldwide due to continuous increase of population density and urbanization. Coastal lagoons, despite being one of the most productive ecosystems on Earth, have been suffering destruction of the goods and services they provide mainly due to lack of recognition of their importance. Ria de Aveiro lagoon is one of the biggest and more important coastal wetland area of Portugal, being remarkably valuable in ecological and economical terms. It is highly pursued by native and non-native visitors for outdoor recreation and nature-based tourism. This ecosystem encompasses a wide range of habitats and biological diversity, indicating a priority for conservation.

Ecosystem conservation goals are achieved by means of sustainable management of their goods and services. Limited financial resources makes it vital to gather all relevant information that reveals the important value of the ecosystem and its natural assets. An integrated multidisciplinary approach of Ecosystem Services Frameworks involves the assessment of information from sociological and economical areas. The inclusion of both research areas in decision-making processes of management policies improves social acceptance and is more likely to be successful. This anthropocentric manner of dealing with environmental issues is a tool to provide useful information that could serve as a justification for allocating financial resources into nature conservation (Goldman et al., 2008).

The maintenance or improvement of ecosystem services has positive social and economic impacts as well as the opposite, their degradation or destruction will have a negative impact (Laurans et al., 2013). With proper management of these ecosystems and their services, nature conservation may be accomplished while providing economic benefits and societal wellbeing. By recognizing the environmental, economic and social importance of coastal wetlands and the ecosystem services provided by them, we can argue that the conservation of these environments should be a priority in the design of future management plans.

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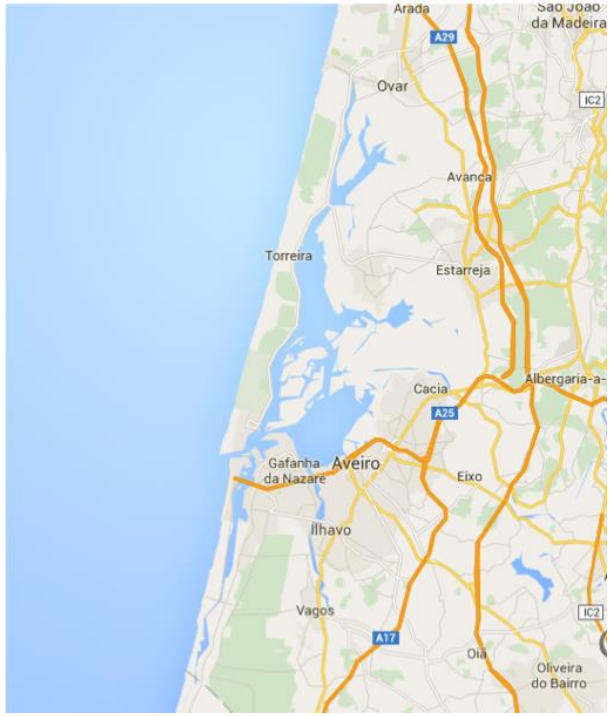
V - APPENDICES

APPENDIX 1: QUESTIONNAIRE (ENGLISH VERSION)

Ria de Aveiro Survey



No_____

Date _____

Surveyor _____

Location:

1. **Aveiro:**
    a. **Tour of Ria boats**
    b. **Private Boats**
    c. **Rossio**
    d. **Canal de São Roque**
    e. **Marina da Troncalhada**
    f. **Caravans Park**
    g. **Forte da Barra**
    h. **São Jacinto**
    i. **Ferryboat piers**

2. **Estarreja**
    a. **BioRia Route: Salreu**
    b. **BioRia Route: Fermelã**

3. **Ilhavo:**
    a. **Praia da Barra**
    b. **Praia da Costa Nova**
    c. **Jardim Oudinot**
    d. **Marina do Clube de Vela da Costa Nova**
    e. **Marina da Associação Náutica da Gafanha da Encarnação**

3. Murtosa:

a. **Praia do Monte Branco**
b. **Torreira**

Q 1: *How many people are in your **group**?*

(a) Young people (17 years or younger)_____

(b) Adults (18 years or older) _____

Q 2: *Where do members of the **group** live?*

*Nearest town **AND** country*	*Postcode*	*Number of young people*	*Number of adults*

Q 3: *In this trip, how many days will **you** be in the Ria de Aveiro?*

_____ days

Q 4: *How long is your **group's** total trip/holiday? (including travel time)*

_____ days

Q 5: *Is **your** trip to the Ria de Aveiro*

A day trip from home ☐

A day trip as part of a longer holiday ☐

A holiday where you stay here for at least one night ☐

Driving past as part of another journey ☐

Q 6: *How have **you** travelled to the Ria de Aveiro on this trip?*

Bus tour ☐

Walking ☐

Motorbike ☐

Small car (less than 2 litres) ☐

Large car (2 litres or more) ☐

4WD ☐

Boat ☐

Other ☐

Q 7: *Did you bring any of the following on your trip to the Ria de Aveiro?*

Tent ☐

Caravan ☐

Camper Trailer ☐

Ski boat ☐

'Jet Ski' ☐

Other boat ☐

Q 8: *Approximately how far have **you** travelled to come to the Ria de Aveiro (one way)?*

From the last overnight stop _____ kms

From home _____ kms

How many overnight stops from home to here? _____

Q 9: *How long did it take **you** to travel to here?*

From the last overnight stop _____ hours

From home _____ days_____ hours

Q 10: *Where were you when your group decided to come to the Ria de Aveiro?*

At home, before you left ☐

While on the trip ☐ (please note where)

Q 11: *Please estimate the trip cost to the Ria de Aveiro for the **group**.*
(If your trip is part of a longer holiday, please just give your best estimates relating to the Ria de Aveiro part of your trip).

- travel costs (eg fuel) _____
- food _____
- accommodation _____
- other (e.g. alcohol, boat costs, tour costs) _____

Total _____

Please indicate the currency eg £ / € _____

Q 12: *How many times have you visited the Ria de Aveiro before?*

None	☐	5 times	☐
1 time	☐	6 – 10 times	☐
2 times	☐	11 – 15 times	☐
3 times	☐	16 – 20 times	☐
4 times	☐	More than 20 times	☐

Q 13: *How many times have you visited the Ria de Aveiro in the past 2 years including this trip?*

_____ *trips*

Q 14: *Please tick the **FOUR** most important **ACTIVITIES** at the Ria de Aveiro for your group*

- Camping ☐
- Picnicking ☐
- Bush walking ☐
- Bird watching ☐
- Nature study ☐
- Sightseeing ☐
- Ria de Aveiro cultural heritage ☐
- Beira Litoral cultural heritage ☐
- Swimming ☐
- Canoeing/kayaking ☐
- Boating ☐
- Water skiing/jet skiing ☐
- 4 wheel driving ☐
- Motorbike riding ☐
- Fishing from shore ☐
- Fishing from boat ☐
- Hunting ☐
- Relaxing ☐
- Boat tour/cruise ☐

Other (please identify) _____

Q 15: *If the Ria de Aveiro area had not been available for your group, what would you have done? (Tick one)*

- Stayed at home ☐
- Gone to another lagoon (eg Lagoa Óbidos) ☐
- Gone to another wetland in the Beira Litoral (eg Pateira de Fermentelos) ☐
- Gone somewhere else on the North coast ☐
- Chosen something else for your holiday ☐

Can you specify where you would have gone? _____

Q 16: *Please tick the **FOUR** **most important** **REASONS** for visiting the Ria de Aveiro for your group.*

- Getting close to nature ☐
- Having quality time with family ☐
- Catching up with friends ☐
- Being close to water ☐
- Water activities ☐
- Relaxing, getting away from it all ☐
- Enjoying this part of the North Coast ☐
- Fishing ☐
- Visiting special spots that we know ☐
- Outdoors activities ☐
- The Ria de Aveiro offers the best combination of activities ☐
- It is good for my wellbeing ☐

Q 17: *Do you think the **recreation opportunities** in the past few years in the Ria de Aveiro have been*

- Increasing in general ☐
- Decreasing in general ☐
- Staying much the same ☐
- Don't know ☐

Q 18: *Do you think **environmental problems** in the past few years in the Ria de Aveiro have been*

- Increasing in general ☐
- Decreasing in general ☐
- Staying much the same ☐
- Don't know ☐

What environmental problem?

We would now like to ask you some questions about your future intentions.

Q 19: *How many times do you expect you will visit the Ria de Aveiro during the next 2 years? Remember your answer, you'll need it again for question 24.*

None	☐	5 times	☐
1 time	☐	6– 10 times	☐
2 times	☐	11 – 15 times	☐
3 times	☐	16 – 20 times	☐
4 times	☐	More than 20 times	☐

Q 20: *How many times do you expect you will visit the Ria de Aveiro during the next 10 years?*

None	☐	5 times	☐
1 time	☐	6 – 10 times	☐
2 times	☐	11 – 15 times	☐
3 times	☐	16 – 20 times	☐
4 times	☐	More than 20 times	☐

Q 21: *Are there specific areas in the Ria de Aveiro that are **special to you** and that you particularly like to use?*

- ☐ No
- ☐ Yes – special camp spots
- ☐ Yes – special water recreation areas
- ☐ Yes – special land recreation areas

If you would like to name one of your special places, please do so.

_____

Q 22: *If the trip had cost **you 10% more**, for whatever reason, would **you** have still decided to come to the Ria de Aveiro?*

- ☐ No
- ☐ Yes
- ☐ Not sure

If yes: Would this payment cover

- ☐ (a) Just you
- ☐ (b) All members of your group

The following 3 questions ask about the decisions you would make if access to good quality recreation at the Ria de Aveiro were changed.

There are many reasons changes could occur. Examples include:

Access could be restricted.

- Low water levels – For example, no dredging of the channels, and inlets restrict easy boat access to the Ria de Aveiro.
- Protection of bird breeding sites means that approximately 50% of the ocean beach is closed for 2 months annually.

Access could be improved.

- More dredging and intervention that keep the inlets open.
- Making more waterways for boating.
- Additional boardwalks built for easier access through the dunes.

Q 23: *If the areas of the Ria de Aveiro that are **special to you** were closed when you were next expecting to visit, would you consider: (Tick one.)*

- ☐ Not applicable, no special areas
- ☐ Going to another part of the Ria de Aveiro
- ☐ Going to another similar area on the coast
- ☐ Using another wetland instead
- ☐ Staying at home
- ☐ Doing something else (other than above)

Please specify _____

Q 24: *How would you respond to changes in access to good quality recreation at the Ria de Aveiro?*
(Please assume that there would be no changes in crowding at the sites compared to current levels.)

Change in good quality recreation area to access	Number of visits you would expect to make in the next 2 years
1. No change	_____ *times - Same as your answer in question 19.*
What if access to good quality recreation changed?	
2. If 10% ***more***	*times*
3. If 25% ***more***	*times*
4. If 10% ***less***	*times*
5. If 25% ***less***	*times*
6. If 50% ***less***	*times*

Tick here if changes to environmental features do not matter to you_____ ☐

Tick here if this question is too confusing to answer _____ ☐

Tick here if your future visit rate is too hard to estimate_____ ☐

Tick here if you will not come back for other reasons _____ ☐

If you would like to, please explain why you have answered the above question in the way that you have._____
_____

Q 25: *Please* ***rate*** *the following statements about water exchange through the lagoon inlets. 'Water exchange" refer to water flowing in and out of the lagoon with the tides. This can be managed specifically to address environmental 'health', including plant health and healthy fish and water bird feeding and breeding conditions.*	1 = Strongly agree	2 = Agree	3 = Neutral	4 = Disagree	5 = Strongly disagree	6 = Do not know
Additional water exchange through the inlets are essential to maintain the current environmental health of the Ria de Aveiro.						
Additional water exchange through the inlets are essential to improve the current environmental health of the Ria de Aveiro.						
Additional water exchange should be managed to keep the inlets open for recreation.						
Better environmental health will improve recreational fishing in the Ria de Aveiro.						
Better environmental health will improve other water-based recreation activities in the Ria de Aveiro (besides fishing).						
Better environmental health will improve camping and walking activities in the Ria de Aveiro.						
Increased water exchange through the inlets will improve jobs in aquaculture-related sectors.						
How would YOU respond to changes in the environmental features YOU enjoy at the Ria de Aveiro? Would the number of visits for you (or your group) change?						

The following 3 questions ask about your sense of wellbeing.

Spending recreation time in nature is known to have important benefits (and sometimes costs) for people's health and overall wellbeing. These health and wellbeing benefits and costs are important for us to understand. To do this, we ask you a short series of questions asking about your overall health and wellbeing, and also about your feelings of attachment to the Ria de Aveiro region. If any of these questions make you feel uncomfortable, you do not need to answer them

Q 26: *How satisfied have you been with life lately? Thinking about your own life and personal circumstances, how satisfied are you with the following?* Please circle one number for each statement on a scale of 0 to 10, where 0 is 'completely dissatisfied' And 10 is 'completely satisfied'

completely dissatisfied<=>completely satisfied											
Your life as a whole	0	1	2	3	4	5	6	7	8	9	10
Your standard of living	0	1	2	3	4	5	6	7	8	9	10
What you are currently achieving in life	0	1	2	3	4	5	6	7	8	9	10
Feeling part of your community	0	1	2	3	4	5	6	7	8	9	10
Your present financial situation	0	1	2	3	4	5	6	7	8	9	10

Q 27: *How would you rate your general health?*

☐	☐	☐	☐	☐
Excellent	Very Good	Good	Fair	Poor

Q 28*:* *To what extent to you agree or disagree with the following statements?* Please circle one number for each statement on a scale of 0-10 where, 0= Strongly disagree and 10 = Strongly agree

Strongly disagree <=>Strongly agree											
I feel very attached to the Ria de Aveiro region	0	1	2	3	4	5	6	7	8	9	10
The Ria de Aveiro region is special to me	0	1	2	3	4	5	6	7	8	9	10
The Ria de Aveiro region is no more important to me than other regions I visit for recreation	0	1	2	3	4	5	6	7	8	9	10
The other regions I visit for holidays aren't as special as the Ria de Aveiro	0	1	2	3	4	5	6	7	8	9	10
I don't feel very strongly attached to the Ria de Aveiro region	0	1	2	3	4	5	6	7	8	9	10

The final questions are to ensure we have a good cross section of the community.

Q 29: *Are you?* Male ☐ Female ☐

Q 30: *What is your age?* _____years

Q 31: *Are you retired?* Yes ☐ No ☐

Q 32: *How many people live in your **household** including you?*

*(a) Young people (17 years or younger)*_____

(b) Adults (18 years or older) _____

Q 33:

	Nationality	*Country of residence / work*
You		
Other members of your group		

Q 34: *Which category best describes your **gross household** income (ie before taxes) in the previous year? Please tick one box.*

We do not keep your income details with your personal details. We need to ask about income because it helps to ensure we have surveyed a good cross section of the population.

Total household income before tax

Please indicate currency - for example

£ OR € OR ____? (GIVE ONE only)

per month	per year	
Less than 415	Less than 5000	☐
415 to 829	5 000 to 9 999	☐
830 to 1 245	10 000 to 14 999	☐
1 246 to 1 660	15 000 to 19 999	☐
1 661 to 2 079	20 000 to 24 999	☐
2 080 to 2 999	25 000 to 35 999	☐
3 000 to 3 999	36 000 to 47 999	☐
4 000 to 5 079	48 000 to 60 999	☐
5 080 to 6 249	61 000 to 74 999	☐
6 250 to 7 499	75 000 to 89 999	☐
7 500 to 8749	90 000 to 104 999	☐
8 750 to 9 999	105 000 to 119 999	☐
10 000 or higher	120 000 or higher	☐

ALL INFORMATION IS COMPLETELY CONFIDENTIAL

You are welcome to make extra comments or suggestions on any issue in the space below.

Thank you for completing this survey.

感謝您完成我們的調查！ **Obrigado por completar a nossa pesquisa**

Σας ευχαριστούμε που συμπληρώσατε την έρευνά μας! **Merci d'avoir répondu à cette enquête !**

Gracias por completar nuestra encuesta. Köszönjük, hogy kitöltötte a felmérést!

Kiitos kyselyymme vastaamisesta! Děkujeme Vám za vyplnění našeho dotazníku!

Tak fordi du udfyldte vores spørgeundersøgelse! **Grazie per aver completato il sondaggio!**

調査にご協力いただきましてありがとうございました! **Vielen Dank für das Ausfüllen der Umfrage!**

Takk for at du fullførte undersøkelsen! Hartelijk dank voor het invullen van onze enquête!

Dziękujemy za wypełnienie ankiety **Muito obrigado por completar o nosso inquérito!**

Благодарим Вас за участие в нашем опросе! Tack för att du tog dig tid att fylla i vårt formulär!

Anketimize katıldığınız için teşekkürler **شكراً لكم على إكمال الاستطلاع !**

感谢您完成我们的问卷调查！ **Дякуємо за участь у нашому опитуванні!**

APPENDIX 2: PERCENTAGES OF RESPONSES TO SOME OPINION QUESTIONS

Q 25: *Please **rate** the following statements about water exchange through the lagoon inlets. 'Water exchange" refer to water flowing in and out of the lagoon with the tides. This can be managed specifically to address environmental 'health', including plant health and healthy fish and water bird feeding and breeding conditions.*	1 = Strongly agree	2 = Agree	3 = Neutral	4 = Disagree	5 = Strongly disagree	6 = Do not know	Non-response
Additional water exchange through the inlets are essential to maintain the current environmental health of the Ria de Aveiro.	32.1	29.5	6.7	2.1	2.1	13.2	14.2
Additional water exchange through the inlets are essential to improve the current environmental health of the Ria de Aveiro.	28.8	28.0	11.1	2.3	1.6	14.0	14.2
Additional water exchange should be managed to keep the inlets open for recreation.	24.1	28.2	14.2	3.6	1.6	13.0	15.3
Better environmental health will improve recreational fishing in the Ria de Aveiro.	34.7	31.6	8.0	0.5	1.3	9.1	14.8
Better environmental health will improve other water-based recreation activities in the Ria de Aveiro (besides fishing).	35.2	33.9	6.2	1.6	0.8	78	14.5
Better environmental health will improve camping and walking activities in the Ria de Aveiro.	29.5	36.3	9.8	1.6	0.8	7.8	14.2
Increased water exchange through the inlets will improve jobs in aquaculture-related sectors.	25.4	26.7	14.8	1.8	1.3	15.5	14.5
How would YOU respond to changes in the environmental features YOU enjoy at the Ria de Aveiro? Would the number of visits for you (or your group) change?	17.1	21.8	25.4	4.1	3.1	14.2	14.2

Q 26: *How satisfied have you been with life lately? Thinking about your own life and personal circumstances, how satisfied are you with the following?*	Totally disagree	Disagree	Neutral	Agree	Totally agree	Non-response
Your life as a whole	0	1.3	15.8	44.8	26.2	11.9
Your standard of living	0	2.8	19.7	45.1	20.2	12.2
What you are currently achieving in life	0.3	1.0	21.8	44.8	18.7	14.0
Feeling part of your community	1.0	0.8	19.9	40.4	23.6	14.2
Your present financial situation	2.1	6.7	32.4	35.5	9.6	13.7

Q 28*: To what extent to you agree or disagree with the following statements?*	Totally disagree	Disagree	Neutral	Agree	Totally agree	Non-response
I feel very attached to the Ria de Aveiro region	4.6	8.3	24	23.1	30.3	9.6
The Ria de Aveiro region is special to me	4.4	6.2	22.3	24.8	32.7	9.6
The Ria de Aveiro region is no more important to me than other regions I visit for recreation	13.4	14	32.4	20.2	9.8	10.1
The other regions I visit for holidays aren't as special as the Ria de Aveiro	8.3	15.5	36.5	17.1	11.4	11.1
I don't feel very strongly attached to the Ria de Aveiro region	36.5	16.9	19.1	9.9	6.5	11.1

APPENDIX 3: RESULTS OF POST HOC ANALYSIS WITH WILCOXON SIGNED-RANK TESTS

	Absolute Differences between Average Rank at .05 significance level					
	Degradation of 50%	Degradation of 25%	Degradation of 10%	No change	Improvement of 10%	Improvement of 25%
Degradation of 50%						
Degradation of 25%	0,561					
Degradation of 10%	**1,299***	**0,738***				
No change	**1,897***	**1,336***	**0,598***			
Improvement of 10%	**2,048***	**1,487***	**0,749***	0,151		
Improvement of 25%	**2,593***	**2,032***	**1,294***	**0,696***	0,545	

APPENDIX 4: RESULTS OF MODEL FITNESS TESTS

TRAVEL COST METHOD

REPORTED COSTS	Poisson	Negative binomial (NB)	Zero-truncated negative binomial (ZTNB)	Zero-truncated negative binomial with endogenous stratification (NBSTRAT)
Number of observations	292	292	292	292
Log likelihood	-2341.99	-982.56	-925.49	-925.59
Degrees of freedom	20	21	21	21
AIC	4723.98	2007.12	1892.99	1893.17
BIC	4797.52	2084.33	1970.20	1970.39

ESTIMATED COSTS	Poisson	Negative binomial (NB)	Zero-truncated negative binomial (ZTNB)	Zero-truncated negative binomial with endogenous stratification (NBSTRAT)
Number of observations	283	283	283	283
Log likelihood	-2222.32	-1081.59	-901.09	-901.20
Degrees of freedom	19	20	20	20
AIC	4482.63	1944.42	1842.17	1842.41
BIC	4551.89	2017.32	1915.08	1915.32

CONTINGENT VALUATION METHOD

ESTIMATED COSTS	Logit	Probit
Number of observations	365	365
Log likelihood	-211.49	-211.81
Degrees of freedom	8	8
AIC	438.98	439.63
BIC	470.18	470.83

APPENDIX 5: RESULTS OF NON-USED MODELS

POISSON MODELS FOR REPORTED COSTS AND ESTIMATED COSTS

	POISSON REPORTED COSTS		POISSON ESTIMATED COSTS	
	COEFFICIENT	STD ERROR	COEFFICIENT	STD ERROR
CONSTANT	1.8688	0.0544	1.8381	0.0584
TRAVEL COST	-0.0003	0.0001	-0.0027	0.0003
BEING FOREIGNER	-1.7893	0.0936	-1.3036	0.0984
NUMBER OF PEOPLE IN GROUP	-0.0311	0.0026	-0.0336	0.0029
NUMBER OF DAYS IN RIA	0.0037	0.0001	0.0032	0.0001
DAY TRIP FROM HOME	0.4285	0.0379	0.5570	0.0406
ACTIVITY				
PICKNICKING	0.3068	0.0318	0.1827	0.0324
BUSHWALKING	0.0709	0.0306	0.0956	0.0311
NATURE STUDY	-0.3603	0.0426	-0.2959	0.0422
RIA DE AVEIRO CULTURAL HERITAGE	-0.5285	0.0391	-0.4882	0.0395
4 WHEEL DRIVING	1.2686	0.0688	-	-
FISHING FROM BOAT	0.7087	0.0428	0.8512	0.0440
RELAXING	0.4404	0.0345	0.5215	0.0361
REASONS				
BEING CLOSE TO WATER	0.3590	0.0316	0.3543	0.0320
ENJOYING THIS PART OF THE NORTH COAST	-0.5303	0.0613	-0.4849	0.0618
BELIEVE RECREATION OPPORTUNITIES DECREASING	0.5951	0.0670	0.5278	0.0656
BELIEVE ENVIRONMENTAL PROBLEMS INCREASING	0.3367	0.0344	0.3428	0.0347
SPECIAL AREAS - WATER	0.4734	0.0307	0.4259	0.0314
RETIRED	-0.3320	0.0502	-0.3276	0.0498
INCOME	5.13e-06	6.58e-07	5.64e-06	6.40e-07
NUMBER OF OBSERVATIONS	292		283	
LOG LIKELIHOOD	-2341.99		-2222.32	
CHI-SQUARE STATISTIC	4768.06 (19 degrees of freedom)		4413.73 (18 degrees of freedom)	
MCFADDEN'S R^2	0.5044		0.4983	
CONSUMER SURPLUS PER GROUP (€)	3 333.33		370.37	

REPORTED COSTS: NEGATIVE BINOMIAL MODEL AND ZERO-TRUNCATED NEGATIVE BINOMIAL WITH ENDOGENOUS STRATIFICATION

	NEGATIVE BINOMIAL REPORTED COSTS		ZERO-TRUNCATED NB ENDOGENOUS REPORTED COSTS	
	COEFFICIENT	STD ERROR	COEFFICIENT	STD ERROR
CONSTANT	1.4598***	0.1841	-19.9104	256.4282
TRAVEL COST	-0.0015***	0.0005	-0.0025***	0.0006
BEING FOREIGNER	-1.5844***	0.1877	-2.4882***	0.2563
NUMBER OF PEOPLE IN GROUP	-0.0236***	0.0062	-0.0306***	0.0083
NUMBER OF DAYS IN RIA	0.0031***	0.0008	0.0032***	0.0010
DAY TRIP FROM HOME	0.5705***	0.1290	0.6748***	0.1588
ACTIVITY				
PICKNICKING	0.3431***	0.1158	0.4865***	0.1441
BUSHWALKING	0.2081*	0.1147	0.2866**	0.1406
NATURE STUDY	-0.4946***	0.1455	-0.6637***	0.1804
RIA DE AVEIRO CULTURAL HERITAGE	-0.3887***	0.1298	-0.4251***	0.1613
4 WHEEL DRIVING	1.2094***	0.4068	1.3775***	0.5010
FISHING FROM BOAT	0.4819*	0.2481	0.5626*	0.3058
RELAXING	0.5147***	0.1178	0.6327***	0.1464
REASONS				
BEING CLOSE TO WATER	0.4184***	0.1169	0.4711***	0.1455
ENJOYING THIS PART OF THE NORTH COAST	-0.3611**	0.1674	-0.4719**	0.2077
BELIEVE RECREATION OPPORTUNITIES DECREASING	1.3868***	0.3472	2.0710***	0.4512
BELIEVE ENVIRONMENTAL PROBLEMS INCREASING	0.5605***	0.1540	0.7262***	0.1933
SPECIAL AREAS - WATER	0.5433***	0.1311	0.6319***	0.1608
RETIRED	-0.3810**	0.1851	-0.5419**	0.2279
INCOME	7.54e-06***	2.56e-06	0.0000***	3.25e-06
α (DISPERSION PARAMETER)	0.6696***	0.0608	1.31e+09	3.36e+11
NUMBER OF OBSERVATIONS	292		292	
LOG LIKELIHOOD	-982.56		-925.59	
CHI-SQUARE STATISTIC	274.43 (19 degrees of freedom)		319.85 (19 degrees of freedom)	
MCFADDEN'S R^2	0.1225			

ESTIMATED COSTS: NEGATIVE BINOMIAL MODEL AND ZERO-TRUNCATED NEGATIVE BINOMIAL WITH ENDOGENOUS STRATIFICATION

	NEGATIVE BINOMIAL ESTIMATED COSTS		ZERO-TRUNCATED NB ENDOGENOUS ESTIMATED COSTS	
	COEFFICIENT	STD ERROR	COEFFICIENT	STD ERROR
CONSTANT	1.4697***	0.1921	-23.2980	113.2352
TRAVEL COST	-0.0019***	0.0007	-0.0024***	0.0008
BEING FOREIGNER	-1.3257***	0.2026	-2.0938***	0.2730
NUMBER OF PEOPLE IN GROUP	-0.0249***	0.0063	-0.0328***	0.0083
NUMBER OF DAYS IN RIA	0.0027***	0.0008	0.0029***	0.0010
DAY TRIP FROM HOME	0.6273***	0.1317	0.7224***	0.1615
ACTIVITY				
PICKNICKING	0.2350**	0.1183	0.3281**	0.1476
BUSHWALKING	0.2564**	0.1164	0.3770***	0.1437
NATURE STUDY	-0.4969***	0.1445	-0.6975***	0.1785
RIA DE AVEIRO CULTURAL HERITAGE	-0.3959***	0.1294	-0.4505***	0.1598
FISHING FROM BOAT	0.7115***	0.2541	0.8817***	0.3160
RELAXING	0.5435***	0.1205	0.6622***	0.1498
REASONS				
BEING CLOSE TO WATER	0.4574***	0.1159	0.5303***	0.1434
ENJOYING THIS PART OF THE NORTH COAST	-0.3942**	0.1675	-0.4911**	0.2068
BELIEVE RECREATION OPPORTUNITIES DECREASING	1.0731***	0.3446	1.6786***	0.4603
BELIEVE ENVIRONMENTAL PROBLEMS INCREASING	0.5329***	0.1513	0.6445***	0.1885
SPECIAL AREAS - WATER	0.4925***	0.1307	0.5883***	0.1619
RETIRED	-0.3098*	0.1860	-0.4215*	0.2298
INCOME	6.53e-06***	2.49e-06	8.47e-06***	3.14e-06
α (DISPERSION PARAMETER)	0.6679***	0.0618	4.01e+10	4.54e+12
NUMBER OF OBSERVATIONS	283		283	
LOG LIKELIHOOD	-952.21		-901.20	
CHI-SQUARE STATISTIC	258.77 (18 degrees of freedom)		292.89 (18 degrees of freedom)	
MCFADDEN'S R^2	0.1196		-	
CONSUMER SURPLUS PER GROUP (€)	526.32		416.66	

PROBIT MODEL FOR ESTIMATED COSTS

	PROBIT ESTIMATED COSTS	
	COEFFICIENT	**STD ERROR**
CONSTANT	0.4365	0.1297
CVM BID VALUE	-0.0068	0.0037
WALKING	-0.7091	0.1749
BRINGING TENT	-0.4784	0.2649
ACTIVITY		
BEIRA LITORAL CULTURAL HERITAGE	-0.8033	0.3002
FISHING FROM SHORE	-0.5347	0.2079
REASONS		
WATER ACTIVITIES	0.5540	0.2187
BELIEVE RECREATIONAL OPPORTUNITIES INCREASING	0.4647	0.1475
NUMBER OF OBSERVATIONS	365	
LOG LIKELIHOOD	-211.81	
CHI-SQUARE STATISTIC	46.80 (7 degrees of freedom)	
MCFADDEN'S R^2	0.0995	

REPORTED COSTS: LOGIT AND PROBIT MODEL – NON SIGNIFICANT

	LOGIT REPORTED COSTS		PROBIT REPORTED COSTS	
	COEFFICIENT	**COEFFICIENT**	**STD ERROR**	**STD ERROR**
CONSTANT	0.5987	0.2030	0.3649	0.1242
CVM BID VALUE	-0.0055	0.0066	-0.0032	0.0041
WALKING	-1.1532	0.2892	-0.6892	0.1745
BRINGING TENT	-0.7731	0.4280	-0.4653	0.2648
ACTIVITY				
BEIRA LITORAL CULTURAL HERITAGE	-1.2875	0.4832	-0.7818	0.2993
FISHING FROM SHORE	-0.8419	0.3352	-0.4988	0.2068
REASONS				
WATER ACTIVITIES	0.9630	0.3878	0.5439	0.2182
BELIEVE RECREATIONAL OPPORTUNITIES INCREASING	0.8483	0.2443	0.5038	0.1460
NUMBER OF OBSERVATIONS	365		365	
LOG LIKELIHOOD	-213.19		-213.52	
CHI-SQUARE STATISTIC	44.06 (7 degrees of freedom)		43.40 (7 degrees of freedom)	
MCFADDEN'S R^2	0.0937		0.0923	